COMPTON'S

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TO STIMULATE THE IMAGINATION, TO PROVIDE THE
INQUIRING MIND WITH ACCURATE
INFORMATION TOLD IN AN INTERESTING
STYLE, AND THUS LEAD INTO
BROADER FIELDS OF KNOWLEDGE,
SUCH IS THE PURPOSE OF
THIS WORK

Volume 3

1956 Edition

PUBLISHED BY
F. E. COMPTON & COMPANY + CHICAGO

1956 EDITION

COMPTON'S PICTURED ENCYCLOPEDIA

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Here and There in This Volume

At odd times when you are just looking for "something interesting to read," without any special plan in mind, this list will help you With this as a guide, you may visit faraway countries, watch people at their work and play, meet famous persons of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment This list is not intended to serve as a table of contents, an index or a study guide For these purposes consult the Fact-Index and the Reference Outlines

Pictures You Will Enjoy

For the Reading Hour

Parent and Child, School and Home

High Lights in History's Pageant

Travel Views at Home and Abroad

Some Famous Men and Women

In the Plant and Animal World

Marvels of Science and Invention

The World at Work

Guideposts to Literature, Art, and Music

Exploring a World of Facts

Interest-Questions Answered in This Volume

What metal was named for a mischievous goblin? 372
What was the first metal worked by man? 473
How large is a newly hatched crocodile? 515
How are railroad ties kept from rotting? 510
How do caterpillars breathe? 137
Why are coconut palms found in so many parts of the world? 374
What is the difference between organic chemistry and inorganic chemistry? 219
Can a cat see in the dark? 135*b*
From what tree do we obtain cork? 479
How does a cicada "sing"? 306 A cricket? 513
Who was the "father of the English language"? 200
Who were the "Lake Poets"? 381
In what country does everybody celebrate his birthday on New Year's Day? 267
Who wrote "Alice's Adventures in Wonderland"? 127
Who was the "real Robinson Crusoe"? 523
Who was the author of "John Gilpin"? 502
What great literary work was burned by a servant maid? 123
Describe an ideal site for a summer camp 57
How do hard and soft coal differ? 363
What causes "caisson disease"? 17
Why are highways intended for fast traffic banked at the curves? 178
Which was the first permanent English settlement in America? 223*a*
What man first gave France national unity? 360
Why were castles built during the Middle Ages? 132
Who was the "mill boy of the slashes"? 341
What are some devices propagandists use to make their arguments sound plausible? 424*g*-*h*
Why was there no October 5 in the year 1582? 22
Who were "The Three Kings of Cologne"? 386
What were the fabled "Seven Cities of Cibola"? 486
Why were the Moslems unable to defeat Charles Martel? 196
Name a great explorer who was killed by a Hawaiian warrior 462 picture
What king owed his throne to a girl? 193
What insect lives 17 years underground? 306
How long can a camel go without water? 52
Of what use is the camel's hump? 51
What birds lay their eggs in other birds' nests? 529
Why did Chinese men formerly wear queues? 264
What animal is most important to a circus and why? 315
Why is it dangerous to stay in a closed garage with an automobile engine running? 120
What plant has blossoms that open at night and wither in daylight? 10
Where did the camellia get its name? 53
Why is coffee roasted? 379
What game is called "warfare in miniature"? 224
How has the cabbage been a friend of man? 1
What fruit gets its name from Corinth, Greece? 530
Why does cork float? 480
Name the Centaur who instructed many famous heroes 170–1
What was "Clinton's Ditch"? 108*b*
Tell how Odysseus and his men got past the giant Polyphemus without being seen 533
What sorceress changed men into beasts? 309
Who or what are the "Gemini"? 135
What did the sowing of a dragon's teeth have to do with the founding of a great city? 13
Why was Cairo built on the east bank of the Nile? 15
What 20-year-old emperor ruled a vaster territory than had any Christian monarch before him? 189
What reward did John Cabot receive for finding the North American mainland? 9
Where and when was the first successful co-operative store opened? 459
Of what English king was it said "He nothing common did or mean"? 191
Why did Canute order the sea to fall back? 117
Where was the "Battle above the Clouds"? 199
What bird has a windpipe five feet long? 506
What Latin American republic owes most of its prosperity to its desert? 251
Where do birds catch fish for their masters? 266 picture
What makes the holes in Swiss cheese? 207
Where is the oldest existing canal? 108*a*
How can bullheads live when their ponds go dry? 139
What is a stalactite? 156
What state has the most mountain peaks? 401
What is the largest shellfish in the world and where is it found? 339 picture
What animal can eat about 86,000 times its own weight in 56 days? 138
Why was the English sparrow imported into the United States? 112
How does a chameleon change its color? 183
What snake can throw its poison from a distance? 373
Why are ants welcome on a coffee plantation? 378
Some cattle do not grow horns. What are they called? 141*a*
What are some of the many uses of the census and why was it first taken? 167
Who advanced the theory that the earth revolves about the sun? 472
What animal can look over its shoulder with one eye and straight ahead with the other? 183
What is the Law of Camp Fire? 55
To what animals do we owe blackboard crayons? 182
How long does a United States copyright extend? 476
What is the basis of chewing gum? 227
When did the Chinese adopt the new calendar? 22
Name the states that meet at right angles to form the famous "four corners" 402 map

KEY TO PRONUNCIATION

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index. Marked letters are sounded as in the following words. cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wȯn, fôr, nŏt, do; cūre, bŭt, rude, fu̧ll, bûrn; out; ü=French *u*, German ü; ġem, ğo; *th*in, *th*en; ṅ=French nasal (Jeaṅ); *zh*= French *j* (*z* in azure); ḵ=German guttural *ch*

C

CABBAGE Through the centuries the cabbage has been the friend of the common man. Its strength-giving qualities have contributed much toward man's physical well-being. When famine threatened, cabbage boiled or raw, sauerkraut, and cabbage soup often saved the lives of entire populations. Easy and quick to grow and usually the cheapest of all vegetables on the market, the cabbage is rich in proteins, carbohydrates, minerals, and vitamins. It thrives best in moist and fairly cool climates. It likes a soil that is well drained and not too heavy.

WHAT CARE HAS DONE FOR THE CABBAGE

The ancestor of the domesticated cabbage (upper picture) was an obscure and scrawny wild cabbage like the one at the bottom. Cultivation has given the same cabbage a big crisp head; the wild cabbage forms no head at all.

The cultivated cabbage consists of a cluster of broad leaves tightly pressed one upon another to form a compact head around a central stem or core. The thick stalk extends about eight inches underground and ends in a cluster of fine rootlets. There are more than one hundred varieties. Some have flattened heads, some are egg shaped, some are perfectly round. The leaves may be smooth or wrinkled, green or red. The kinds that have wrinkled leaves are often called Savoy cabbages. All these different varieties have been developed through the centuries from a single species, the wild cabbage of western European coasts.

The Mustard Family

The mustard family (*Cruciferae* or *Brassicaceae*) to which the cabbage belongs includes many other common vegetables. Some are varieties of cabbage and have the same wild ancestor (*Brassica oleracea*). Among these varieties are kale, cauliflower and broccoli, and Brussels sprouts. Closely related species are the kohlrabi, the turnip, the rutabaga, the black mustard, and the white mustard. Less closely related are the radish, the horse radish, and the water cress.

The most nearly like the wild cabbage is the kale. It forms no heads but spreads its leaves outward from its stalk. The long curving leaves may be green, blue, or varicolored, curly or almost flat. The curly leaved varieties are prized for greens. The giant of the kales is the so-called Jersey cabbage or tree cabbage that grows eight to ten feet tall in the Channel Islands. Its stout stem is used for walking sticks and cottage rafters; its leaves are used as fodder.

Cauliflower and Broccoli

Cauliflower forms a head of flowers instead of leaves. The flowers, white and tightly clustered, are delicious either boiled or pickled. Broccoli is a variety of cauliflower with green, loosely clustered flowers, which are eaten with the tender stalks.

Brussels sprouts (named for Brussels, Belgium, the early growing center) are crowded with tiny heads all along the stalk. The top has spreading leaves. The baby cabbages, one to two inches in diameter, are esteemed as a table delicacy.

Kohlrabi and Turnip

The queer kohlrabi (*Brassica caulorapa*) starts out like a cabbage, but instead of heading it finally thickens its stem to form a turnip-like globe that sits right on *top of the ground*. Kohlrabis are eaten raw or cooked.

The turnip (*Brassica rapa*) is one of the most valuable root crops. Millions of people and cattle as well eat the nourishing roots. The tender tops of early spring turnips are used for greens. The rutabaga or Swedish turnip (*Brassica napobrassica*) is grown in northern latitudes. Garden varieties are smaller than field turnips, which may weigh from 20 to 25 pounds.

Mustards are particularly noted for the sharp pungent taste that characterizes this whole family of

IMPORTANT RELATIVES OF THE COMMON CABBAGE

1. Icicle radishes, crisp roots with a "bite" 2. Turnips, one of the world's chief root crops. 3. Brussels sprouts, like tiny cabbages on a stalk. 4. Cauliflower, a cabbage that forms its head with flowers. 5. Kohlrabi, with its peculiar globular stem.

vegetables. Though sometimes used for salad, the black mustard (*Brassica nigra*) and the white mustard (*Brassica hirta*) are grown chiefly for their seeds, which are ground up to make the familiar powdered mustard (*see* Mustard).

Radishes and Water Cress

Radishes (*Raphanus sativus*), with their globular or elongated roots, are delicious as relishes or in salads, and the young leaves are eaten as greens. Seeds sown in early spring mature into edible roots in four to six weeks. The coarser root of the horse-radish (*Armoracia rusticana*), with its biting tang, is grated and steeped in vinegar with salt and sugar to make condiments. To subdue its extreme sharpness, it is often mixed with grated turnip. Water cress (*Nasturtium officinale*), a trailing plant whose brittle shoots take root in mud or water, has a piquant flavor that makes it a favorite in many salads. It thrives in ditches and pools, and can be grown with little trouble in frames and other places where the ground is kept wet.

The common cabbage is eaten more extensively than all of its relatives combined. It is fortunate that such an appetizing food should be so nourishing. It is especially rich in calcium, sulphur, iron, and potassium. Also, dietitians class it with egg yolk, green peas, milk, cheese, and asparagus as a "good" source of vitamin A. They class it with asparagus, avocado, and currants as a "very good" source of vitamin C. Vitamin B_1 is also present in cabbage.

The cabbage-mustard group gets its family name (*Cruciferae*, "cross-bearers") from the fact that the flowers have four petals, which resemble a Maltese cross. Usually the flowers are small but abundant. They may be white, yellow, orange, lilac, or purple.

CABEZA DE VACA (*kä-bä thä dä vä kä*) **ALVAR NÚÑEZ** (1490–1557) The first white man to cross what is now the state of Texas was that extraordinary Spaniard Cabeza de Vaca Perhaps no more fantastic bit of exploration was ever carried out in the New World

It began with a shipwreck on an island outside Matagorda Bay in 1528 Here and on the mainland the 80 survivors were reduced to 15 by starvation and disease and were virtual prisoners of the Indians Cabeza de Vaca alone dreamed of escape He succeeded in 1530 but remained in the vicinity urging his *former shipmates* to accompany him in trying to find a Spanish settlement Finally in 1534 he was joined by two Spaniards and a black slave Then began the long trek westward He traveled from tribe to tribe showing such honest Christian charity and zeal that he was taken for a great medicine man Thus he made his way over the hot plains crossed the Rio Grande beyond the Pecos River and descended *into the heart* of Mexico On July 23 1536 he met *Cortez in* Mexico City

Cabeza de Vaca returned to Spain the next year In 1540 he led an expedition from the coast of South America into Paraguay through a thousand miles of mountains and jungle But it seems that he got along well only with Indians While governor of Paraguay he was blamed for a rebellion among his subordinates in 1544 was sent back to Spain and imprisoned in Seville for nearly six years His health broken he was then dismissed with a pittance from the crown

Cabeza de Vaca means head of a cow One of his ances*tors was a shepherd who* during the Moorish wars *marked* a secret pass through the mountains with a cow s head This helped to bring victory to the Christian armies in the fa*mous battle of* Las Navas *de* Tolosa (1212) The shepherd won noble rank and the new name

CABINET The head of a nation usually gathers around himself a group of men he can trust to advise him and to help manage the details of government Such a group came to be called a cabinet when the king of England began to meet secretly with a few of his trusted councilors in his cabinet or private office

The word cabinet does not appear in the United States Constitution although executive departments are mentioned incidentally It was expected that the president would appoint officers to assist him but not that they would form an advisory body If he wanted *advice it was* thought that he would go to the Senate for it Washington however early turned to his department heads instead At first he met with them individually but soon he began to invite some or all of them to more formal meetings By 1793 the meetings had become fairly regular and his advisers soon became known as the President s Cabinet

THE FIRST CABINET OF THE UNITED STATES

The four members of the first Cabinet were (left to right) Henry Knox secretary of *war* Thomas Jefferson *secretary of state* Alexander Hamilton *secretary of the* treasury and Edmund Randolph attorney general. An attendant stands at the door

The Departments of State *Treasury and War* were created by Congress in its first session in 1789 The heads of these departments together with the attorney general formed the first Cabinet The Department of the *Navy was created in 1798 and the* postmaster general was raised to the rank of a department head in 1829 In 1849 the Department of the Interior was established and in 1870 the attorney general was made head of the Department of Justice The head of the Department of Agriculture was made a Cabinet member in *1889* A Department of Commerce and Labor was established in 1903 and divided into two departments in 1913 *In 1947* a new *Cabinet post was created by the Na*tional Security Act The secretary of defense replaced the secretaries of war and navy as a member of the Cabinet The War Department was reorganized

as the Department of the Army; the Navy Department was reorganized; and a new Department of the Air Force was formed. These three departments are headed by secretaries without Cabinet rank. In 1953 the Department of Health, Education, and Welfare was created and given Cabinet status.

The president selects the department heads. The appointments are approved by the Senate, but approval is seldom withheld. The president may dismiss any Cabinet member by asking for his resignation.

The president customarily chooses Cabinet members from different parts of the country. Often the chairman of his party is made postmaster general, since the duties of the postoffice are chiefly routine. Critics complain when a president appoints his intimate friends as department heads; but it is natural that he should want in his Cabinet people whose advice he trusts. He is sometimes criticized for not appointing specialists to the offices, but this criticism does not take into account the philosophy of the American government. For example, the people usually want the secretary of defense to represent the civilian view of military affairs. Specialized knowledge is supplied by undersecretaries and assistant secretaries. (For an account of the work of the departments, *see* United States Government.)

How the Cabinet Does Its Work

The Cabinet meets regularly at the White House on days appointed by the president. Special meetings are called in emergencies. The members sit at an octagonal table and flank the president. The secretary of state sits on the president's right, the secretary of the treasury on his left, and so on around to the most recently created departments. Meetings are informal and no records are kept. Questions are rarely put to a vote, as the president alone makes the final decision. Lincoln once brought before the Cabinet a proposition which he favored, and every member voted against it. He announced the vote thus: "Seven nays, one aye; the ayes have it."

The government of the United States is based upon the principle that the executive, judicial, and lawmaking powers should be in separate hands. Therefore no department head may be at the same time a member of Congress. A Cabinet member may, however, be invited to give information or opinions before a congressional committee.

The British Cabinet System

Great Britain had a Cabinet long before American independence. Its Cabinet no doubt suggested the American Cabinet, but it differs widely from the American type. The United States has a congressional government. Great Britain has a parliamentary system, sometimes called *Cabinet government*. Cabinet government has been adopted by the nations of the Commonwealth, by many European countries, and by other countries throughout the world.

Theoretically the British Cabinet advises the crown (the king or queen) as the American Cabinet advises the president. Actually, however, the Cabinet is the pivot around which the whole government revolves. Individually the Cabinet members administer the various departments of state. Together they formulate policy on all major issues and propose legislation. They are all members of Parliament.

The prime minister (called in some countries the *premier*) is in practice the directing head of the government. In Great Britain he is formally appointed by the crown. In fact, however, he is chosen by the people, since the crown must name a party leader in the House of Commons who can command a majority of its votes. The prime minister then chooses some 50 ministers from members of the House of Commons or the House of Lords. Of these he selects some 20 or more to serve in the Cabinet. The prime minister and other Cabinet members form the *ministry*. The entire ministry is known as the *government*.

The prime minister may drop or add Cabinet posts as he wishes. He may also give one minister two or more posts. He himself may hold one or more specific Cabinet posts—nearly always he is first lord of the treasury. The most important offices after that of prime minister are secretary of state for foreign affairs; chancellor of the exchequer (who is concerned with public finance); secretary of state for home affairs; and the lord high chancellor (who is concerned with courts of justice in England, but not in Scotland).

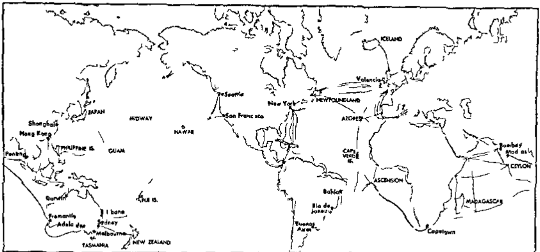
The "government" remains in office only so long as it has the support of Parliament. If the government is defeated on the voting of an important issue, one of two things may happen: (1) The entire ministry resigns and the crown asks the leader of the opposition to form a new government; (2) the prime minister calls upon the king or queen to dissolve Parliament and a new election is held. The leader of the victorious party, or coalition of parties, is then called upon to form a new government.

Origin of the British Cabinet

In its earliest form, the British Cabinet goes back to the Privy Council that used to meet for advising the kings of medieval England. As the council grew in size, the kings became accustomed to form an inner circle of special advisers. After the Revolution of 1688 the king was obliged to choose his special advisers from members of Parliament. George I turned over the business of presiding at meetings to Sir Robert Walpole, who thus became the first prime minister in the modern sense—that is, he was the first leader of the House of Commons to preside at Cabinet meetings. The Cabinet still meets in Walpole's house, No. 10 Downing Street, which has become famous as the official residence of Britain's prime ministers.

The traditional Privy Council of the crown still survives. It is now an honorary body and meets only at the beginning of a new reign or when the reigning sovereign announces his or her marriage. The title "privy councilor" is conferred on each Cabinet minister when he takes office and he holds this title for life. It is also given to other distinguished persons as a mark of honor.

The CABLES *that* BIND *the* WORLD TOGETHER



Here we see the giant communication web—comprising about 3 500 lines and costing approximately 250 million dollars—that man has *spun to bring the great land areas of the earth closer to one another* Every *important seaport in the world is* linked with this cable system In all, about 350 000 miles of cables have been laid—enough to girdle the globe almost 15 times Of this great mileage, about 75 per cent is owned by private cable companies

CABLES In the murky depths of the oceans lie the slender armor plated strands of copper wire that were the earliest electrical links between the world's continents These submarine cables form a network which for many decades was the only means of swift communication from one part of the world to another More recently, radio has come to play an important part in the transmission of messages across the seas, but the cables still carry most of the traffic

More than 25 cables span the Atlantic Ocean, and most of them stretch along the same high plateau of the ocean bed where the first cable was laid This is called the "Telegraph Plateau" because it is comparatively level, with the deepest point about two miles down The ocean bottom in this area is covered with soft mud that coats the cables protectingly Like the dry land regions of the earth, much of the ocean floor has mountains, valleys, and plains The broad plateau running from the Grand Banks of Newfoundland to southern Ireland made it possible to use much shorter and lighter cable than if it had to cross high ridges and deep valleys

The cable routes across the Pacific Ocean are fewer than those in the Atlantic One of the two principal cables from the New World westward to the Orient begins at San Francisco and touches at Honolulu Midway Island, Guam, and Manila, and thence to its terminus at Hong Kong A spur extends to Tokyo from Guam The service west of Midway Island was interrupted during the second World War when the Japanese severed the cable at Guam The other Pacific cable of greatest importance runs from Vancouver in Canada to New Zealand and Australia

The Composition of an Undersea Cable

Because water is a good conductor of electricity, ocean cables must be carefully insulated to keep the electricity in the wire from escaping They must be strong to withstand injuries from rocks, ships' anchors, and fishing trawls The high-speed cables used today consist of a central copper wire about one-fifth of an inch in diameter which carries the electric current Long copper strips surround the transmission wire, and the "core" thus formed is wrapped with a narrow tape made of "permalloy" a magnetic alloy of iron and nickel This tape forms a continuous coil around the cable which offsets the tendency of the cable circuit to resist *changes* in the *electric current Since the signals that pass over* the cables are formed by changes and interruptions of the current, the coil is an essential factor in modern high speed transmission It makes it pos-

THE ROUGH ROAD THAT CABLES HAVE TO TRAVEL

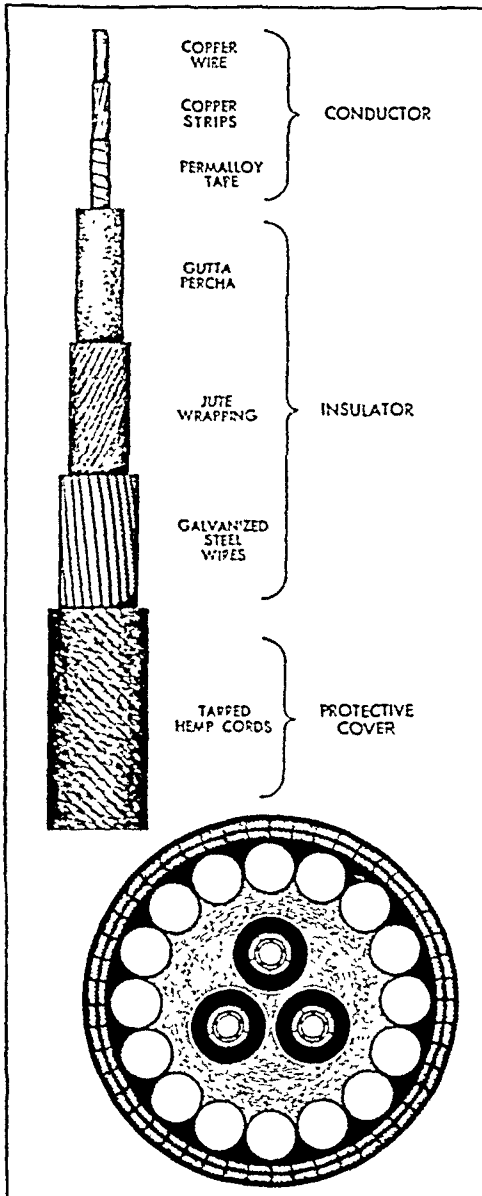
A view through the Pacific Ocean from San Francisco to Manila in the Philippines would look something like this for the sea bottom, like the land, has its mountain peaks and its yawning chasms The cable is strung between the highest peaks, which are islands, and loops down to the irregular ocean floor between them

sible to send at a rate of more than 2,000 letters a minute—about four times the capacity of the old cables.

A layer of gutta-percha insulation covers the three-part metal center of the cable. Around this rubber-like substance are wound bands of jute, which in turn are covered by a protecting layer of galvanized steel wires. Then comes the outside covering —a wrapping of tarred hemp cords that keeps the cable's steel-wire armor from corroding.

A submarine cable has varying thicknesses, depending on the depth at which it lies on the ocean floor. At the greatest depths, where the cable is relatively safe from marine animals, anchors, and large rocks, it is slightly less than an inch in diameter and weighs from one to one and a half tons a mile. In shallower water, however —where it is more exposed to damage—a cable is so heavily armored that its diameter increases to as much as two or three inches and its weight rises to more than ten tons a mile. One of the cable's most persistent enemies in shallow water is the teredo or shipworm which bores through hemp or gutta-percha. To thwart it, cable makers may encase the whole cable with a covering of brass tape. The usual life span of a deep-sea cable ranges from 30 to 40 years.

THE PARTS OF A MARINE CABLE



In this diagram we see the elements that comprise the three parts of a deep-sea cable. Although cables differ in thickness, their construction is the same. At the top is a portion of a cable cut open in such a way as to show its various "layers." This telescoped section has only one central copper wire for transmitting messages. The cross section below—which is the actual thickness of the shore end of a cable—shows three conductor wires. This cable, therefore, can carry three times as many messages as the one above.

How Messages Are Sent by Cable

When a current is sent over 2,000 miles of cable, much of its strength is dissipated by the wire's resistance and by the electrical interactions between the wire, its various coverings, and the ocean water. As a result, the signals that reach the other end are very feeble. So electronic detectors and amplifiers are used similar to those made for radio reception. At junction stations, where cables come to the surface, automatic relays also strengthen cable signals and may be used to transfer messages from one cable to another. This avoids the delay which formerly occurred when messages had to be taken down and sent out again by hand.

The common code used to transmit messages over ocean cables is an adaptation of International Morse code. For years, of course, all cable messages were sent by hand. Operators tapped the dot-and-dash electric impulses directly into the cable wire by a key similar to the old-fashioned telegraph key. To make more effective use of the high-speed cable, an automatic device was developed that took over the greater portion of the sending job. This device resembles the multiplex instruments now used in land telegraphy (*see* Telegraph). They make it possible to send four messages at a time in each direction, and errors in transmission are reduced about 80 per cent.

Instruments for transmitting photographs can be attached to submarine cables, and work as effectively as they do over land wires (*see* Telephotography).

How a Cable Is Laid

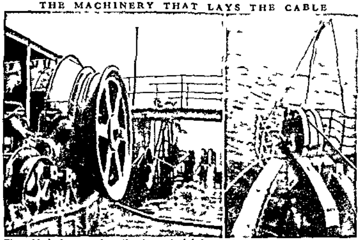
The task of laying a submarine cable requires a high degree of accuracy and skill on the part of the cable ship's crew. There are about 45 cable-laying ships in the world. The average cable ship carries 3,000 to 4,000 miles of cable in large tanks filled with water to prevent deterioration of the gutta-percha. A ship can lay about 200 miles a day and, if not delayed by breakdowns, will lay the main section of an Atlantic cable in ten days.

Before a new cable is laid, soundings are made of the ocean bottom along the proposed route and the exact depths are charted. This makes it possible to avoid the greatest depths, where repair work would be difficult, and it also establishes the amount of cable that will have to be laid.

During the laying operation, the coiled cable unwinds in the storage tanks below deck and passes "top-

side" to a braking drum that regulates the strain on the cable From the drum the cable passes through a dynamometer, an instrument that registers the amount of stress continuously Then the cable runs through a guiding contrivance at the stern and drops into the sea As it sinks to the ocean floor, the cable describes a great arc behind the ship, finally touching the bottom many miles back In sectors of the ocean where it is advisable to do so, a cable may be "plowed under" to protect it from injury. A submarine plow is dragged behind the cable ship and in one operation cuts a trench in the ocean bed, buries the cable from six inches to two feet, and then scrapes mud over it

THE MACHINERY THAT LAYS THE CABLE



The cable is drawn up from the storage tank below deck, passes several times around the braking drum at the left, and then goes through the dynamometer which measures the strain exerted on the cable From there it runs aft to the paying out sheave, at the right, that guides the cable a descent into the sea

While a cable is being laid, electrical tests are made periodically to guard against breaks and weaknesses in the wire Once a day the ship exchanges messages with the shore on the progress of the work, and these messages pass through all the cable stored in the ship's tanks

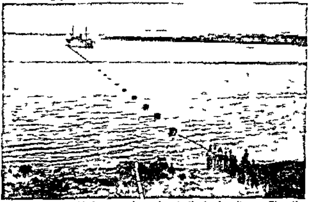
A cable ship, of course, cannot get close enough to shore to run the cable up onto the land When the ship has approached as near land as possible, a small boat takes the heavy shore end of the cable, supported by barrel floats, to land There it is attached to the land portion, the other end is spliced to the deep-sea part of the cable, and the operation is finished

Early Cables Plagued by Difficulties

Attempts to telegraph under water were made even before the first land telegraph was generally used in 1844, and Morse, inventor of the telegraph (*see* Morse, Samuel F B), had predicted that Europe and America would one day be connected by telegraph Nearly 25 years passed, however, before Morse's prediction was fulfilled In 1851 a cable was laid between Dover and Calais and within the next few years several short lines were in operation connecting various parts of the continent and England The longest line was only 117 miles, so when Cyrus W Field, an American capitalist, proposed to lay a cable from America to Ireland, a distance of nearly 2,000 miles, the project was generally received with skepticism and ridicule One distinguished English scientist announced to the world that "it was a mathematical impossibility to submerge a cable in safety at so great a depth," and that "if it were possible, no signals could be transmitted through so great a length" But Field was undaunted by such croakings and he formed a company which in 1856 laid a cable 85 miles long, connecting St John's, Newfoundland, with Cape Breton Island Canada, thus forming the first link in a transatlantic line

Field then formed a company in England to provide the $1,750 000 necessary for the rest of the enterprise Foremost among his associates were two Englishmen, Sir Charles Bright and William Thomson, later Lord Kelvin A cable was built with 340,000 miles of wire woven into strands—100 000 miles more than needed to reach to the moon Two ships, the *Niagara* and the *Agamemnon*, were loaned by the United States and English governments, and the great enterprise was launched in 1857—the same year that saw the first telegraph line completed across the American continent The start was made with ceremony from the coast of Ireland, but the cable broke when only 100 miles out

FLOATING THE CABLE TO SHORE



The cable laying ship has come in as close to the land as it can Then the heavy shore end of the cable is floated in by means of casks After it is fastened to the shore cable the casks are cut loose and the cable sinks to the bottom, ready to be put into operation

Field and Bright were not discouraged, and they made a second attempt the following year The same

THE FIRST CABLE AND ITS MANY TROUBLES

This is an episode in the brave story of the men whose courage and persistence resulted in the laying of the first transatlantic cable. The cable broke repeatedly, but finally that famous ship *Great Eastern* accomplished the feat of binding together the Old World and the New. This picture shows the cable that had been lost the year before being fished up and a new piece spliced in.

two ships met in mid-ocean, each carrying a part of the heavy cable. The two sections were spliced together, and the ships steamed away toward the opposite shores, each unreeling its part of the cable. Twice the cable parted after a number of miles had been covered, and twice it was spliced anew, but all in vain. After a third break the effort had to be abandoned.

A storm of ridicule broke on the luckless promoters, and many of the stockholders were in favor of abandoning the enterprise. But Field's ardor prevailed, and a month later the ships once more met in mid-ocean, again spliced their cables, and proceeded cautiously on their way. Ships passed too near for the safety of the sinking cable, and floating icebergs and the antics of a whale near by gave rise to much fear and anxiety; but at last, on Aug. 5, 1858, each ship reached its harbor with the 2,000 miles of precious cable still intact and with telegraph signals still passing through it. The rejoicing was general on both sides of the water. Queen Victoria and President Buchanan exchanged congratulatory cable messages, because of the new bond of union between the two countries; and the men who had persevered in the face of such obstacles were publicly honored. Less than three months later, however, the messages grew gradually feebler and finally ceased. The wires had been burned out by the use of too strong currents, and the whole gigantic task had to be begun anew.

Although Field was undaunted by these failures, public confidence was gone. The breaking out of the Civil War in America and other causes stopped further active attempts for seven years. Meanwhile Thomson had perfected his delicate receiving instrument, and Field was tireless in his attempts to raise new capital. Though he was desperately seasick whenever he went to sea, Field crossed the Atlantic 74 times to promote this enterprise.

At last, in 1865, Field and Thomson loaded a new cable on the *Great Eastern*, the largest ship then afloat. When half the journey had been made the cable parted and sank. The next year saw the same two men once more on the giant ship, laying a new cable. This time success crowned their efforts. The ship then turned about, and with improved grappling tackle succeeded in raising the cable that had been lost the year before. A new section was spliced on and the ship returned to shore, completing the second cable between Europe and America. Improvement in the making and laying of cables continued, and other cables were soon in operation.

The First Cables in the Pacific

Cable laying in the Pacific was much more difficult than in the Atlantic because of the greater distance and greater depth. The first Pacific cable was laid in 1902, connecting Vancouver, Canada, with Australia and New Zealand. It is about 8,000 miles long, and one span from Vancouver to Fanning Island is 3,600 miles. This cable system was duplicated in 1926 to meet the demands of the increasingly heavy traffic. The other Pacific cable was completed in 1903, from San Francisco to Manila, at a cost of $12,000,000.

CAB'OT, JOHN (1450–1499?). In May 1497 a tiny ship, the *Mathew*, sailed from Bristol, England, with a crew of 18 men. The ship was setting out on a momentous voyage. The captain was John Cabot, an Italian born in Columbus' own city of Genoa; but

he was sailing under the flag of King Henry VII of England Henry had unwisely refused to help Columbus when he was trying to fit out his expedition Five years later he was delighted to give permission for Cabot's voyage

Cabot was sure that he could reach the coast of Asia by sailing westward Boldly he steered his small ship across the stormy Atlantic After several weeks of peril and hardship he sighted the coast of North America on June 24 1497 The land he discovered was probably Cape Breton Island and the nearby island "New Found Land" When Cabot returned with news of his discovery the king gave him ten pounds and the rank of admiral

The next year 1498 Cabot set out on a second voyage with two ships and 300 men He intended to sail down the coast he had already found which he believed to be the extreme northeast of Asia He thus hoped to find Japan or Cipango as it was then called Instead he discovered the barren shores of Labrador which he named Afterward he sailed as far south as Maryland There he abandoned his search for Japan because his supplies had run dangerously low It is thought that he died in Bristol shortly after his return from this voyage

Cabot was the first European to reach the shores of North America since the days of the old Northmen England later laid claim to the whole of North America on the ground that Cabot was the first discoverer to reach the mainland

SEBASTIAN CABOT (1476? 1557?) son of John Cabot may have accompanied his father on his voyages but he is first heard of as a map maker for Henry VIII In 1526 he commanded a Spanish expedition to South America Seeking a strait to the Pacific he entered the Plata, Paraná and Paraguay rivers In his later years he returned to England and in 1552 founded the Muscovy Company to find a northeast passage to Asia The ships sent out by this company opened up the Russian market to England

CACAO This valuable tree, native to the tropical parts of the American continents, produces the seeds from which the world's supply of chocolate and cocoa is made It is an evergreen, ever blooming tree ranging from 20 to 40 feet in height The leaves are large oval, and glossy dark green above and red below The flowers and fruit grow in a peculiar position springing in numerous clusters directly from the trunk and older branches The fruit is a pod about the size of a small cucumber, green at first and purplish yellow when ripe It grows on a stem so short that it looks as if it were artificially attached to the tree The hard leathery rind about half an inch thick, contains five to eight rows of white or pale purple beans—from 29 to 50 altogether—embedded in a sweet pink pulp These beans are the raw material of chocolate and cocoa (see Chocolate)

CACAO BEANS IN THE POD

The pod has been cut open to show how the seeds grow inside In nature the pod is about three times this size.

The principal producers are West Africa's Gold Coast Nigeria and French West Africa, South America's Brazil, Ecuador, and Venezuela, and the West Indies' Dominican Republic Mexican production is increasing Scientific name *Theobroma cacao*

CACTUS The most precious thing in the desert is water, and each desert animal or plant has through ages worked out its own answer to the problem of how to survive with very little water The cactus does this in a very interesting way Leaves on plants which grow under ordinary conditions are very wasteful of water, taking it up from the sap and giving it out to the air in a process called transpiration To avoid this waste of water the cactus has given up having leaves and has its stems of such form as to expose as little surface as possible to the direct rays of the sun, which make the plant give up its moisture Also the stems are thick so as to give room for the storage of water, and protected with thick covering to keep it safely hoarded

There are many forms of *cacti* (as the plural is written) The most impressive is the "giant cactus" of Arizona belonging to the genus *Cereus* Its stems and branches are like huge spiny columns from one to two feet thick It often grows from 40 to 50 feet high and looks like a giant candlestick This cactus has long, tubular, very showy flowers The fruit is egg-shaped and has a crimson pulp which the Indians use for food, they gather it with a forked stick attached to a long pole Woodpeckers dig out their nests in the big stems

Some cacti are in the form of very spiny globes Those with flat stems belong to the genus *Opuntia*, a good example of which is the common 'prickly pear" Of these there are many species but they are all alike in having their stems and branches in roundish flattened sections and jointed They have small fleshy leaves which fall off and at the base of each is left a tuft of cruel spines of two sorts, meant for the punishment of any thirsty trespasser The prickly pear has yellow or reddish showy flowers, and a pear-shaped fruit which is delicious and satisfying to thirst Certain species of *Opuntia* which were introduced into Australia as a pretty flowering hedge, have run wild and become "the world's greatest vegetable terror," spreading their vicious thorny plants over miles and miles of valuable grazing and farming lands

Cacti are found native chiefly in the arid regions of America—in Arizona New Mexico, Central America, and extending to southern South America About a thousand species have been named, varying greatly in form and size Many curious and beautiful varieties are

prized as hothouse plants, among them the "night-blooming cereus," whose lovely waxlike blossoms open in a single night and wither at the approach of sunlight.

From the juicy stems of the cactus primitive peoples long ago learned to distill both medicines and intoxicating drinks. It was long known that were it not for the prickly spines the cactus would furnish excellent fodder for cattle, and Luther Burbank spent many years in experimentation to produce a spineless cactus.

Scientific name of giant cactus, *Cereus giganteus;* a common species of edible prickly pear is the *Opuntia engelmannii;* the globe cactus is *Echinocactus horizonthalonius.*

CADILLAC (*kă-dĭ-yak'*), **ANTOINE DE LA MOTHE** (1656?–1730). Born in Gascony, France, of noble family, Cadillac was destined to have a stormy career. An older brother was guilty of embezzlement, and the father impoverished himself to clear the family name. Antoine was forced to become an army cadet at an early age in order to receive an education. At 21 he was promoted to the rank of lieutenant. He was almost penniless and wholly lacking in influence at court; he was homely and had an exceptionally long nose which court ladies ridiculed. And yet he impressed Louis XIV with his nimble wit, his courage, his honesty, and his swordsmanship. It has been said that Edmond Rostand's play 'Cyrano de Bergerac' was inspired in part by Cadillac.

King Louis was badly in need of such a man. French administrators in America were profiting at the expense of the home government and it was impossible to get accurate reports. So in the year 1683, Cadillac was dispatched to New France to work under Governor Frontenac as private investigator for the king. Naturally, in this role, he was not popular with the scheming administrators. Immediately, and as long as he was a power in America, his enemies were many and his friends few.

Most historians agree that Cadillac was hot-tempered, haughty, and moody. He is accused of having been overly ambitious, of missing no opportunity to amass a personal fortune. These faults were common among American pioneers. But it has never been proved that Cadillac's personal ambition interfered with his faithful services to his country.

His Prosperous Colony at Detroit

In 1689 he reported personally to King Louis, and returned to New France in 1690. From 1691 to 1699 he commanded an important post at Mackinac at the head of Lake Michigan, although much of his time was spent at Montreal and Quebec. His outstanding achievement was the founding of Detroit. With 50 settlers, 50 soldiers, and two priests, he arrived at the site of Detroit on July 24, 1701. The canoe trip had taken 49 days. A stockade was built, streets and lots laid out, homes erected. By the end of August the colony was snugly housed. He made peace among Indian tribes and settled them on land close to Detroit. The fur trade of the colony prospered. But Cadillac's temper and pride caused so much enmity that, in 1704, he was tried in Quebec for official misconduct. Nothing came of this trial, however, and he returned to govern his settlement.

There, Cadillac had surrounded himself with Old World luxuries, including table silver, Venetian glassware, stoves, and damask linens. His swashbuckling soldiers wore gorgeous uniforms, plumed three-cornered hats, thigh-length boots, and silver spurs. But unlike other communities in New France, Detroit was self-supporting, and all the king had to pay was the soldiers' wages. The other administrators were extremely jealous.

His Transfer to Louisiana Territory

Realizing at last that they could not discredit him with Louis XIV, Cadillac's enemies tried a new tack. They suggested that he was too big for the little community of Detroit, and that he should be transferred to the Louisiana territory, which extended from the Great Lakes to the Gulf. Their efforts this time were successful, and in 1712 Cadillac was officially informed of his transfer.

Broken-hearted, he sailed to France to learn the duties required of him. He took up his administrative work in Louisiana in May 1713. He had heard much of the wealth of the great territory—of the silver and other precious metals. All he found of metals were some lead deposits in Illinois.

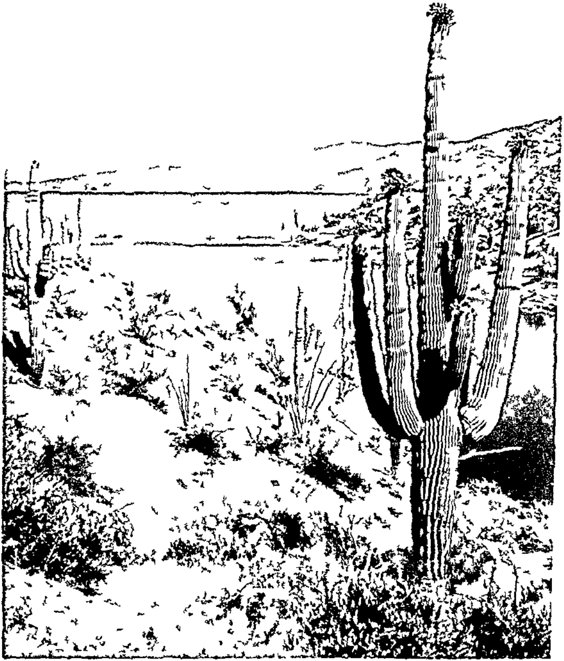
"The wretched country is good for nothing," he wrote. "The people are no better than the country—scum, refuse, ruffians who cheat the gibbet." He saw nothing of beauty in his new home on the Mississippi, just north of present-day New Orleans. He saw only squalor, snakes, and alligators. He had but 40 soldiers, unkempt and undisciplined, who looked mostly to the Indians for food. Duels were fought daily.

After writing innumerable indignant letters to France, he was recalled in 1717. He spent a short time as a prisoner in the Bastille, then retired with his wife and 13 children to a small castle near his birthplace. He died in 1730, never forgiving the people who had caused him to lose his beloved Detroit.

CADMIUM. In nature this important metal is usually found associated with zinc, and some of its uses are similar to those of the parent metal. The name cadmium is from the Latin *cadmia,* meaning "Cadmean earth," an ore of zinc. All cadmium is recovered as a by-product of the refining of zinc or lead.

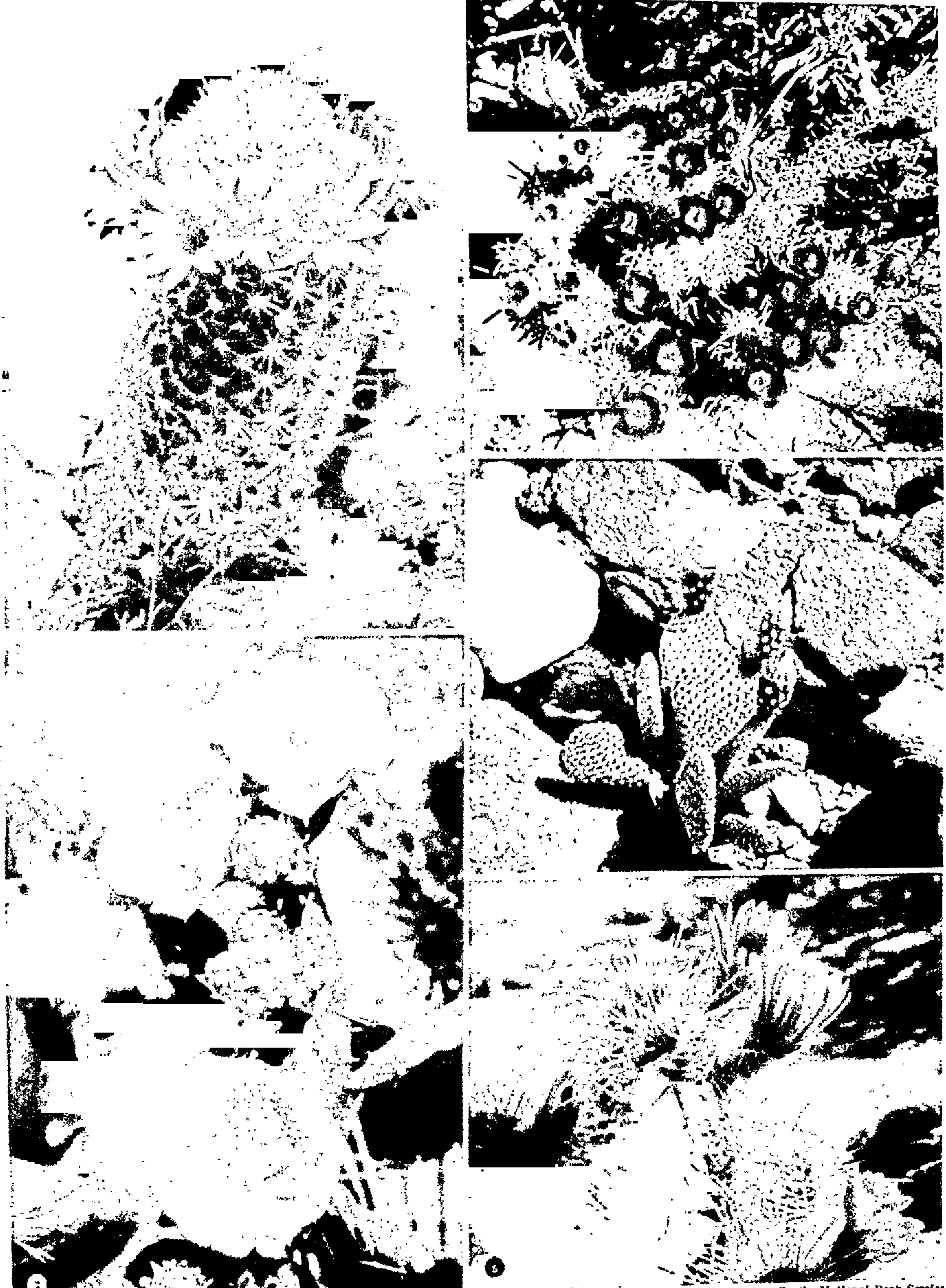
The greatest use of cadmium is in plating steel. Cadmium plating is used for automobile and airplane parts, electrical equipment, and hardware such as screws and nails. Cadmium-plated articles are superior to zinc-plated (galvanized) pieces in several respects. Cadmium better resists corrosion of air and salt water and keeps a shiny appearance. It is deposited more quickly than zinc and it forms an even coating on intricately shaped pieces. A thin deposit of cadmium protects metal as well as a heavier coating of zinc. Since cadmium is easily attacked by mineral acids which combine with it to form poisonous salts, it is not suitable for plating food containers.

Alloys of cadmium are valuable in industry. Bearings containing more than 98 per cent of cadmium are



BIGGEST OF THE CACTUS FAMILY

The giant saguaro cactus is a living reservoir. Its tall branching stem stores water from the rare desert rains and so keeps itself alive during long periods of drought. The buds at the tips of the arms will open into beautiful white flowers. In the background is San Carlos Lake formed by the great Coolidge Dam in Arizona.



Direct-color photographs — *By the National Park Service*

BLOSSOMS AMONG THE THORNS

1. The fishhook or pincushion cactus (*Mammillaria microcarpa*). 2. Prickly pear cactus (*Opuntia engelmannii*). 3. Strawberry cactus (*Echinocereus stramineus*). 4. Beavertail cactus (*Opuntia basilaris*). 5. Hedgehog cactus (*Echinocereus polyacanthus*).

used in internal combustion engines because they withstand high speeds and high temperatures The addition of a small amount of cadmium strengthens the copper of electric wires Cadmium also enters into many alloys of low melting point used for electric fuses and other fire-control devices (*see* Alloys) Sometimes it is substituted for tin in solders

Cadmium compounds have long been important Cadmium oxide is used in the negative plates of cadmium-nickel storage batteries (*see* Battery) The halides cadmium bromide and cadmium iodide, are used in photography and photoengraving Other compounds are important as pigments Used in ceramics, cadmium acetate gives an iridescent effect, and cadmium nitrate imparts a reddish-yellow sheen Cadmium sulfide (cadmium yellow) is used in high-quality paints, inks, and glazes

Metallic cadmium (chemical symbol Cd) is a lustrous silvery element discovered in 1817 by Friedrich Stromeyer It is softer than zinc but harder than tin and has a fibrous texture It melts at 610° F (321° C) and vaporizes at 1 413° F (767° C) The United States produces nearly three fourths of the world s supply of cadmium Other important producers are Mexico and South West Africa (*See also* Chemistry, Periodic Table)

CAD'MUS Once upon a time Zeus the chief of the Greek gods, took upon himself the shape of a bull and carried off the maiden Europa Her brother Cadmus, together with his mother and brothers, went to recover her After a long vain search Cadmus consulted the Delphic oracle who told him to give up his quest follow a cow which he should meet, and wherever she lay down to build a city

Cadmus met the cow and followed her to Boeotia, where she lay down near a spring But a dragon lay in hiding near the spring and killed Cadmus' comrades He slew the dragon and then the goddess Athena appeared and ordered him to sow the dragon's teeth like seed in the ground Cadmus obeyed, and immediately armed men sprang up They fought among themselves until only five remained These became Cadmus' subjects and helped him create his new city, Thebes A later legend says that Cadmus brought the Phoenician alphabet into Greece and so became "the father of letters"

CAEDMON (*kăd'mŭn*) (7th century A D) The earliest of English Christian poets, Caedmon, spent most of his life as an uneducated cowherd The Anglo-Saxon historian Bede tells how Caedmon became a poet in his 'Ecclesiastical History of the English Nation'

Leaving a banquet hall because he could not join in the verse making and singing, Caedmon lay down in the cow barn and slept An angel appeared to him and said "Caedmon, sing something for me" He replied 'I can sing nothing Because of that I left the banquet and came out here, for I do not know how to sing anything ' "But you can sing for me, the angel said 'What shall I sing?' "Sing to me of the Creation ' Then Caedmon composed and sang a little hymn of nine lines in praise of the Creator

Later the abbess of Whitby learned of his gift With her help he became an inmate of a monastery There he spent the rest of his life composing hymns and poems on Biblical stories Scholars once attributed most of the Anglo-Saxon or Old English, religious verse to Caedmon But the only work definitely known to be his is the famous hymn

ROME'S *Great* GENERAL, *Who* "CAME, SAW, CONQUERED"

CAESAR, GAIUS JULIUS (102?–44 B C) Daggers of assassins ended the career of the great Julius Caesar before he had finished his lifework But what he accomplished made him one of the few men who changed the course of the world s civilization Some historians consider him Rome's greatest genius He was a soldier of remarkable ability, an accomplished scholar and writer, and a statesman gifted with enormous insight He changed the chaos of an outworn system of government into the foundations of a new order From it arose the greatest of all ancient empires The new order also preserved the civilization which is our inheritance today

His Adventures with Pirates

When Caesar was a young man he was captured by pirates in the eastern Mediterranean When they told him he must give them 20 talents for ransom or they would put him to death, he laughingly said "What! Only 20 talents? I will give you 50 talents for my life!"

While messengers were gone to Miletus for the money, Caesar joked with his captors and vowed to hang them all some day The pirates were greatly amused at his high spirits They had no idea that he would come back to carry out his threat But Caesar was a man of his word, and within a few weeks after his release the whole pirate band was captured and was put to death

How Caesar Won the Roman People

Hiding his serious character under a mask of light-hearted gaiety, Caesar made himself a favorite with the people of Rome When he was overseer of public games (66 B C), he increased his popularity by preparing magnificent spectacles in the Circus Maximus for the pleasure-loving Romans at the cost of a crushing burden of debt for himself The dignified Roman senators would have laughed to scorn the suggestion that this careless young fop would some day be the conqueror of the world the most powerful man in Rome No one realized that his smiling manner covered a shrewd penetration and purpose He saw the rottenness of the existing government and the need of a strong central power to save Rome from decay He felt that he himself was the one person to bring this change about This was his determined aim and as a part of his plan he formed a political alliance with the two most powerful men in Rome, the wealthy Crassus and the popular general Pompey As a result Caesar was elected consul in 59 B C After his year

of office, the senators, who were beginning to be alarmed at his power, were glad to see him sent as proconsul to Gaul, the country we now call France.

Here was Caesar's chance to prepare for the changes in Rome which he knew must come. While in Gaul he built up a well-trained army, subdued all Gaul, put down a dangerous uprising under a leader named Vercingetorix, made a successful invasion across the Rhine, and twice led his army into Britain. He did not conquer any part of Britain, but he paved the way for the Roman occupation of that island a century later. During these years of war and conquest, Caesar not only showed his ability as a great leader and organizer, but endeared himself to his soldiers so that they would follow him anywhere. He worked with them, fought with them, and endured the same hardships. When at one time his men mutinied at the appalling dangers they were called upon to face, Caesar shamed them into obedience by declaring that if all others deserted him, he would go on with the faithful Tenth Legion alone.

Crassus was now dead and Pompey, jealous of the growing power of Caesar, had veered around to the side of the senate. Caesar was commanded to disband his army, but knowing that this would mean his political ruin he refused. Instead, he led his loyal forces across the little river Rubicon, in northern Italy, which was the southern boundary of his province, and marched against Rome. From this action, which amounted to a declaration of war against the senate, comes our expression to "cross the Rubicon," meaning to take action which will inevitably bring certain consequences.

THE SURRENDER OF VERCINGETORIX

This brave and able Gallic chief was the deadliest foe Rome had met since the days of Hannibal. When Caesar's generalship had made further resistance hopeless, Vercingetorix rode full-armed to Caesar's camp and surrendered himself as a sacrifice for his people. Caesar brought him to Rome to grace his triumph and to suffer death at the foot of the Capitol.

During the five years of civil war which followed Caesar's appearance at Rome, he put down rebellions in Spain, decisively defeated Pompey at Pharsalus (in Greece), and was successful in overthrowing his opponents in Egypt, Africa, and Asia Minor. It was from Asia Minor that he sent his famous message to the senate: "I came, I saw, I conquered."

Caesar was now master of all the Roman world. Recognizing that the old institutions of the republic were outworn and dead in all but name, he sought to build a new and stronger order in which the supreme power should be in the hands of one capable man. He had himself made dictator for life, took the title of "imperator," assumed the powers of all the leading offices of the state, and set on foot many far-reaching reforms. But there were still many of the old oligarchy who could not tolerate the idea of a one-man rule, even though it brought good government, and they plotted to take his life.

The senate was to hold a meeting on March 15 (called by the Romans "the ides of March"), and the plotters determined that the dictator should die on that day. Among the conspirators was Caesar's friend Marcus Junius Brutus, a Roman of such stern virtue that he was ready to sacrifice his friend and benefactor to what he believed to be the cause of liberty. Caesar was warned by a soothsayer to "beware the ides of March," and his wife Calpurnia begged him to remain home from the senate that day; but the conspirators persuaded him to attend the meeting

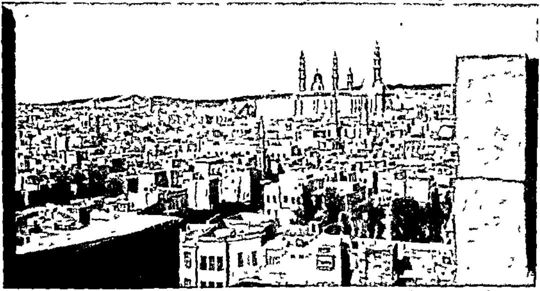
No sooner was Caesar in the senate chamber than he was surrounded by the conspirators. At a signal

they drew their daggers and attacked him At first Caesar tried to defend himself but the attempt was hopeless When he saw his friend Brutus with a dagger in his hand, he gave up the struggle, saying 'Thou too, Brutus?' (et tu Brute?) He fell dead at the foot of Pompey's statue

The murder of Caesar deprived Rome of perhaps its greatest statesman and soldier His murderers who had tried to save the republic failed to achieve their aims, for 14 years later Caesar's nephew Octavian became emperor of Rome (see Augustus) The next four emperors also belonged to the family of the Caesars, and the imperial name gained such dignity that it became a title of honor The name survived to the first World War as the official title (Kaiser) of the German and Austrian rulers

Julius Caesar was as able a writer as he was an administrator In the midst of his military campaigns he found time to record the events in which he was taking part The simple straightforward prose of his interesting history of the Gallic wars is familiar to every student of Latin

EGYPT'S CAPITAL, *Founded by* ARAB CONQUERORS



This picture shows a few of the many domes, minarets, and closely packed dwellings of the colorful city of Cairo, capital of Egypt In the background the rocky and barren Mokattam hills rise 550 feet above the city

CAIRO (*kī'rō*), EGYPT The largest city in Africa is Cairo, the capital of Egypt It stands at the head of the Nile delta near the point where the river begins to divide into many channels

There was no city here in the time of the Pharaohs, nor in later Greek or Roman days It came into existence in the 7th century A D after the Byzantine power in Egypt had crumbled before the Mohammedan armies advancing from Arabia The great city of Alexandria, at the western end of the Nile delta, surrendered without a battle The victorious general Amru wanted to make this seaport the Mohammedan capital "Behold," he said, "a city ready made for us!" But Calif Omar, organizer of the Moslem power, saw that the Nile floods would cut off Alexandria from the Arabian homeland Therefore he asked Amru to build him a new city east of the river

Amru selected a site on the right bank of the Nile above the delta In the centuries that followed, the Mohammedans warred among themselves and the settlement was several times destroyed and rebuilt The present city was founded in 968 by the Fatimite dynasty near the earlier site It was called El Qahira ("the victorious"), a name since altered to Cairo

In the 12th century the great Mohammedan ruler Saladin built a citadel at Cairo and began to wall in the quarters of the diverse peoples who had settled there The city grew and prospered and in the later Middle Ages became the center of trade between Europe and the East and one of the chief seats of Mohammedan culture In 1517 it fell to the Turks In 1798 it was seized by Napoleon, but British and Turkish forces drove the French out three years later, and the city was handed back to the Turks The English, however, retained special interests in Cairo A modern European city grew up in the 19th century between the oriental quarters and the river The later history of Cairo is merged with that of Egypt (see Egypt)

In the Shadow of the Pyramids

Cairo spreads east from the Nile to the low Mokattam hills, which separate it from the brown wastes of the desert The citadel of Saladin still stands on a spur of these hills, in the southeast corner of the city From this height we may look across the island-

studded Nile to the great Pyramids of Gizeh which loom darkly on the western horizon.

A Glimpse into the Old City

Below us lies the city, with its bulbous domes and graceful minarets of the Arab section, the synagogues of the Jewish quarter, and the Christian churches of the Europeans and Copts. In the foreign colony the streets are wide, the buildings modern. Consulates, theaters, hotels, cafés, and attractive shops surround a 20-acre park. A definitely European atmosphere prevails.

But the foreign colony is not Cairo. Cairo is the maze of narrow and crooked streets swarming with Arabs and Copts, Jews and Nubians, Turks and Greeks. Cairo is the blaze of white and yellow walls in the sunlight, the bazaars with the jostle and push of turbaned crowds, the nasal whining of the merchants, the singsong calls of the faithful at prayertime. It is the beggars squatting in the market place, and the open-front shops with their carpets and gaudy jewelry, their candies and rings of bread, their oranges, bananas, and dates, and their cackling hens. Cairo is the patient plodding buffaloes drawing carts, the clop-clop of heavy-burdened donkeys on dusty streets, and the rhythmic tinkle of camel bells.

A University, One Thousand Years Old

The El Azhar Mosque in Cairo was founded about 970 A.D., and immediately converted into a university. For centuries it has been the center of Mohammedan learning, and students come from all over the Islamic world to study here. Instruction is free. The students—some 12,000—sit on mats upon the ground in little groups about their teachers, taking notes, or swaying gently from side to side as they repeat some singsong phrase. For centuries, teaching at El Azhar was confined almost exclusively to the sacred writings of the Moslems. Recently, however, sweeping changes have been made, and courses of study include many subjects taught at our Western universities. El Azhar's library contains some 60,000 volumes, many of which are in manuscript and very old. Other educational institutions in Cairo are Egypt's state university (Fuad University), which was founded in 1908 and reorganized in 1925 by King Fuad I along European lines; and the American University, which offers courses in Oriental studies to foreigners and natives alike. There are many native elementary schools, and a number of secondary schools and teachers' colleges.

STREET SCENE IN OLD CAIRO

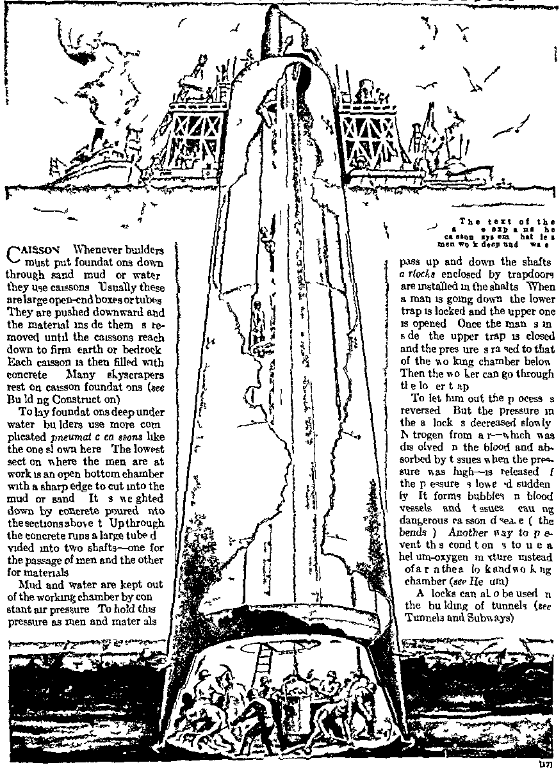
This is the Muski, one of the market streets of the city. To this place come Bedouins of the desert to trade at the stores and bazaars and camel drivers to outfit their caravans. Although Cairo has a modern street car system, many people ride in donkey carts as their ancestors did.

Cairo's two museums are of special interest. The Museum of Egyptian Antiquities cost more than a million dollars and houses ancient Egyptian relics. The Arab Museum and Royal Library, in addition to its ancient treasures, contains 100,000 volumes of books and manuscripts.

Commerce and Industries

The commerce of Cairo is extensive. Gum arabic, ivory, and hides from the Sudan, cotton and sugar from upper Egypt, rugs and shawls from Persia, tobacco from Turkey, and a great variety of European products pass through the city. Its chief industries are cotton manufacturing and sugar refining. Other products are attar of roses, wood and metal work, and ornaments of gold and silver, inlaid with ivory and pearl.

Cairo is the seat of the Egyptian government. During the second World War, it was the scene of an historic conference between Franklin Roosevelt, Winston Churchill, and Chiang Kai-shek. Population (1947 census), 2,100,506.



The text of the article explains the caisson system that lets men work deep under water

CAISSON Whenever builders must put foundations down through sand mud or water they use caissons Usually these are large open-end boxes or tubes They are pushed downward and the material inside them is removed until the caissons reach down to firm earth or bedrock Each caisson is then filled with concrete Many skyscrapers rest on caisson foundations (*see* Building Construction)

To lay foundations deep under water builders use more complicated *pneumatic caissons* like the one shown here The lowest section where the men are at work is an open bottom chamber with a sharp edge to cut into the mud or sand It is weighted down by concrete poured into the sections above it Up through the concrete runs a large tube divided into two shafts—one for the passage of men and the other for materials

Mud and water are kept out of the working chamber by constant air pressure To hold this pressure as men and materials pass up and down the shafts *airlocks* enclosed by trapdoors are installed in the shafts When a man is going down the lower trap is locked and the upper one is opened Once the man is inside the upper trap is closed and the pressure is raised to that of the working chamber below Then the worker can go through the lower trap

To let him out the process is reversed But the pressure in the airlock is decreased slowly Nitrogen from air—which was dissolved in the blood and absorbed by tissues when the pressure was high—is released If the pressure is lowered suddenly It forms bubbles in blood vessels and tissues causing dangerous caisson disease ("the bends") Another way to prevent this condition is to use a helium-oxygen mixture instead of air in the airlock and working chamber (*see* Helium)

Airlocks can also be used in the building of tunnels (*see* Tunnels and Subways)

CALAIS (*kă-lĕ'*), **FRANCE.** This seaport of France, on the Strait of Dover, was an outpost of English power during the time of the Hundred Years' War. It was captured by Edward III of England in 1347 after a seige of 11 months and came to be regarded as one of England's most valuable possessions. This boast was written over one of its gates:

> Then shall Frenchmen Calais win,
> When iron and lead like cork shall swim.

The French, however, captured it in 1558. Its loss so saddened Queen Mary Tudor that she declared, as she lay on her deathbed, that Calais would be found graven on her heart.

Calais today has a good harbor and is connected with Dover by steamer and by a submarine telegraph. It is one of the chief ports for passengers traveling to and from England, for at Calais the English Channel narrows to only about 20 miles in width. Calais is a center of the machine-made lace industry and also produces glassware and textiles. The herring, cod, and mackerel fisheries also employ many men.

During World War I, this strategic channel port withstood German attack. In 1940 it was badly damaged by German fire, and when France was defeated it became a German base for action against England. It was often and severely bombarded by the British. Population (1946 census), 41,536.

CALCIUM. Nearly every drink of water you take gives you some calcium salts, for "hard" water, such as comes from wells, springs, and rivers, gets this quality from compounds of calcium and magnesium dissolved in it.

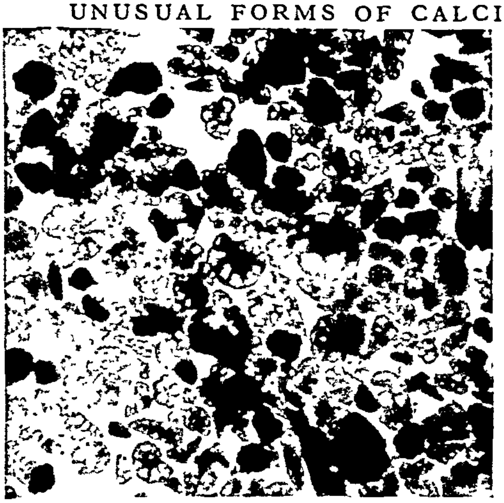
Calcium is not found free. In its many compounds it is the fifth in abundance in the list of elements. Plants need calcium compounds for growth, and a soluble form of *calcium phosphate*, called superphosphate, is a good fertilizer, since it is readily absorbed. Green vegetables, fruits, and milk are essential to the diet, especially for children, because from these foods the body gets calcium and some phosphate for bone formation. Calcium salts in the food help counteract acidity; lack of calcium helps cause rickets.

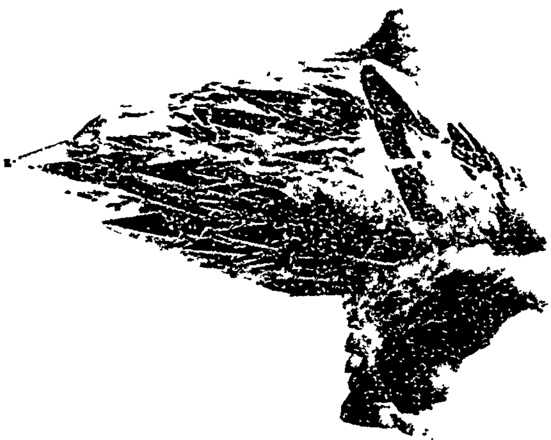
Limestone, marble, chalk, Iceland spar, coral, pearls, and eggshells are all made up mainly of calcium carbonate (*see* Limestone; Marble). Chalk is composed of calcium deposits which were the shells of marine protozoa (*see* Chalk). Calcite is a crystalline form of calcium carbonate, and Iceland spar, one of its varieties, has the power of producing double refraction of light. Carbon dioxide, present in most water, helps dissolve calcium carbonate, so that in limestone caves the evaporation of dripping water produces beautiful and fantastic stalactites and stalagmites.

Quicklime is the oxide of calcium. When exposed to air it takes up carbon dioxide and becomes calcium carbonate. It is then said to be "air-slaked" and is useless as lime (*see* Lime). "Water-slaked" lime is *calcium hydroxide*. When mixed with sand and hair it forms plaster. When calcium hydroxide absorbs carbon dioxide it then becomes calcium carbonate. Since there is little carbon dioxide in the air, there is plenty of time to put the plaster on the wall before it hardens.

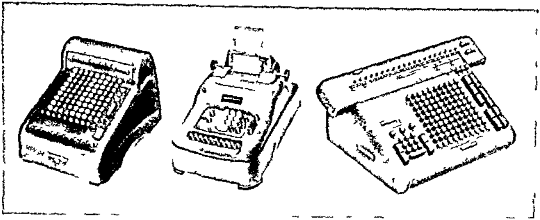
Gypsum and plaster of Paris are *calcium sulphate* (*see* Gypsum). *Calcium carbide* is made by heating limestone with coke in an electric furnace. With water, calcium carbide produces acetylene gas (*see* Acetylene). Calcium carbide is also used in a process of nitrogen fixation. When heated with nitrogen, a mixture of carbon and calcium cyanamide is produced which is used as a fertilizer. When treated with hot water or superheated steam ammonia results (*see* Ammonia; Nitrogen). *Calcium chloride*, a by-product in soda manufacture and other processes, absorbs moisture and is used to settle road dust.

UNUSUAL FORMS OF CALCIUM IN FOSSILS AND A CRYSTAL





The tiny objects shown at the left are the microscopic shells of sea-dwelling protozoans called *foraminifera*. The shells consist of calcium carbonate. When the creatures died millions of years ago, the shells drifted to the bottom and gradually formed a deposit which today is chalk. Shown at the right is a crystal of *calcite*, made up of ions of calcium carbonate.



The key-drive (left) the key-set (center) and the rotary calculators (right) are the common calculating machines used to solve the arithmetic problems of business

MACHINES *That Solve* MATHEMATICAL PROBLEMS

CALCULATING MACHINES These amazing machines range from small desk devices for doing sums' to their big brothers the giant brains that can solve complex mathematical problems in less time than the twinkling of an eye In size they range from small portable mechanisms such as a bombsight to huge *electronic simulators* that test proposed designs of airplanes and guided missiles

Names such as 'mechanical brains or thinking machines" are often applied to all kinds of calculating machines Actually there are two distinct classes *digital computers* and *analogue computers* They are very unlike in construction operation and use

Digital computers are so named because they work with digits or numbers They might also be called arithmetic machines because the primary operations they can perform are the addition subtraction multiplication and division of numbers

Analogue computers are so named because they often work on an analogy or model principle by using directly measurable quantities such as mechanical motions voltages resistances and hydraulic forces to represent the problem to be solved

The Digital Class of Calculators

Examples of machines that use digital computing *principles include adding machines desk calculators* bookkeeping machines cash registers punched-card business machines and giant electronic computers The giant electronic machines although highly publicized as mysterious and awesome thinking machines are not hard to understand Basically all they can do is to add subtract multiply and divide numbers Digital computers cannot think no matter how large or complex they are They can perform tedious arithmetical operations much faster and more accurately than humans For example some electronic computers can add or subtract 16 000 numbers a second

Many millions of the digital type of machine varying widely in size and purpose are now used in offices, banks stores universities and laboratories Most of them operate on simple mechanical principles

How Mechanical Calculators Work

The basic part of every mechanical calculator is a set of numeral adding wheels These wheels can be seen through the row of small windows along the front of the machine Each wheel has the numbers 0 to 9 marked around its outside rim and each is connected through an ingenious mechanism to the row of nine keys directly above it This mechanism enables the No 1 key when depressed to rotate its wheel one step the No 2 key to rotate the wheel two steps and so on If we press the No 1 key the wheel below would advance to '1 When we push the No 2 key the wheel advances two more steps so that it now reads 3 —the sum of one and two

A column of numbers can be added rapidly by simply entering them in the keyboard and reading the sum in the windows Interlocking mechanisms between the numeral wheels provide for carry-overs automatically To multiply on this and almost all other machines multiplication is treated as successive additions For example to multiply 5 by 3 we would press the No 5 key down three times in rapid succession and the answer 15 would appear in the windows Division *is similarly performed as successive subtractions*

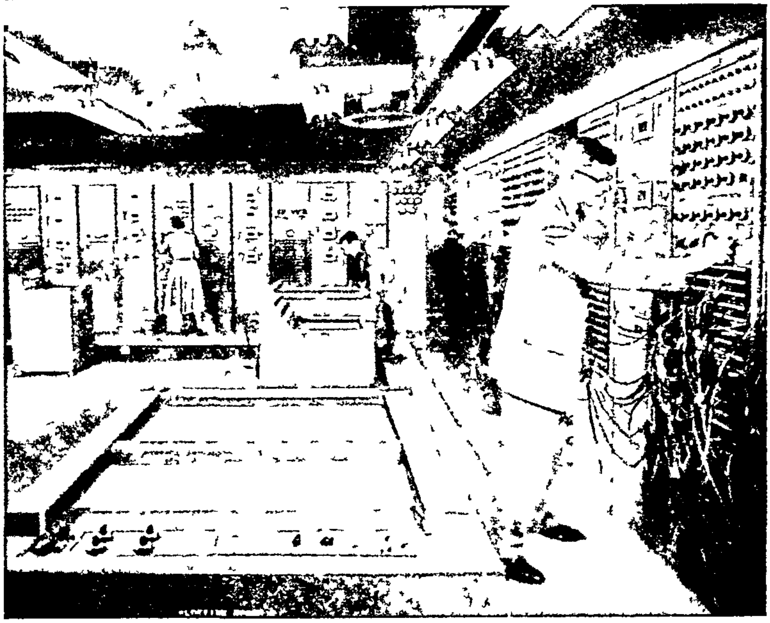
Examples of Mechanical Calculating Machines

Key-driven calculators as described above can be operated very rapidly by skilled operators because the number wheels are operated directly from the keys Since most business arithmetic involves only simple addition and multiplication of small numbers machines of this type are used widely in business offices The first commercially successful key-driven calculator later called the *Comptometer* was invented by Dorr E Felt in 1885

In *key set machines* the number keys are first depressed or cocked Then a second motion—such as turning a crank or starting a drive motor—is required

to complete the machine cycle. The key-set principle is used in all machines that provide printers for automatic recording of results, since it is not feasible to drive printers directly from the keys. Adding machines of many varieties have been developed over the past 50 years and have become very popular wherever figures are handled in large volumes. About 350,000 adding machines are manufactured every year by 12 companies in the United States.

THIS ARRAY OF MACHINERY WORKS BY ELECTRONICS



This electronic analogue computer solves problems by simulating the conditions by electrical and electronic means In a guided missile flight problem, the plotting board in the foreground would show the flight path, while recorders in the rear show conditions of test.

Rotary calculators are so named because they use a rotary drive mechanism to transfer numbers set into the keyboard into the adding-wheel unit. Because the rotary drive lends itself to high-speed repeated addition or subtraction, these machines can be used to do multiplications and divisions rapidly and automatically. The first commercially successful machine was developed by Frank S. Baldwin and Jay R. Monroe in 1911. Baldwin invented his first calculator in 1872. He worked on it for 40 years before he succeeded. He was often referred to as the "man who achieved success after 80." Rotary calculators are now made in the United States by three manufacturers.

More Complex Business Machines

Bookkeeping machines are now so well known that it is hard to believe that less than 70 years ago bookkeepers had to do all their tedious figuring by hand methods. A bank clerk, William S. Burroughs, suffered a breakdown in health from overwork and decided to invent a machine that would take the drudgery out of bookkeeping. After many years he produced a successful adding-printing machine in 1891, and thus launched a revolution in the world's bookkeeping methods.

At that time, banks were the largest users of such machines. Today banks could not cope with their work without machine aids. In one recent year, United States banks handled nearly 8 billion checks, worth about 2 trillion dollars. A wide variety of bookkeeping, billing, and accounting machines are now manufactured in the United States by half a dozen companies. They perform many computations automatically.

Cash registers of modern design have been provided with elaborate computing mechanisms that have extended their usefulness far beyond the original purpose of insuring the honesty of clerks. The cash register was invented in 1879 by James Ritty of Dayton, Ohio, and it was made commercially successful by John H. Patterson, who founded the National Cash Register Company in 1884. Many millions of these machines are in use today in stores throughout the world (*see* Cash Register).

Punched-card business machines use calculating devices in many different ways and have been used widely to make scientific and engineering calculations. Equipment now manufactured by the International Business Machines Corporation, which reads cards electrically, had its beginnings in the work done by Herman Hollerith in the 1880's for the United States Bureau of the Census. The Remington Rand equipment, which reads cards mechanically, originated in the developments of James Powers in the 1900's—also for the Census Bureau (*see* Census).

Electronic Calculating Machines

Electronic calculators are being built to solve hitherto insurmountable problems in many fields of science. Defense problems in atomic energy, jet engines, aircraft design, and guided missiles, for example, created the initial demand for these machines. They are now being applied to peacetime problems also.

Electronic calculators can perform all the arithmetic functions of addition, subtraction, multiplication, and division at very high speeds and thus can solve problems beyond the reach of ordinary methods. An atomic energy problem that takes two hours to solve on an electronic computer would require 4,000 weeks to work on a desk computer and 800 years with pencil and paper.

Inside an Electronic Computer

The machines discussed so far all employ mechanical adding wheels in their basic adding mechanisms. To speed up calculations, it was necessary to find a

THIS MACHINERY PERFORMS FROM 2,000 TO 16,000 OPERATIONS A SECOND

This IBM digital electronic calculator was put to work in April 1953 Punched cards feed the data into the machine Magnetic drums and tapes and cathode-ray tubes are the "memory" devices The answers are printed on paper at the right. This machine can multiply and divide more than 2 000 times a second. It can add and subtract more than 16 000 times a second

substitute that could count faster than the wheel The electron tube was the answer Circuits using electron tubes can count and add pulses at the rate of millions per second (*see* Electrons and Electronics)

It was also necessary to find a substitute for the slow keyboard to enter data into the machine This was accomplished by recording information on punched cards, punched tapes, or magnetic tapes so that numbers and instructions may be fed into computers as rapidly as needed Electronic calculators, when working at high speeds, need an electronic "scratch pad," or "memory," device to store important factors and partial results This has been accomplished by storing pulses temporarily in the form of magnetized spots on magnetic drums, supersonic shock waves in mercury tanks, electronic spots on the face of cathode-ray tubes, and in miniature magnetic cores

Some Outstanding Giant Calculators

Prior to World War II work on large-scale computers was pioneered by Dr Howard H Aiken of Harvard University, Dr Vannevar Bush at the Massachusetts Institute of Technology, Dr Wallace J Eckert of Columbia University, Dr George R Stibitz at Bell Telephone Laboratories, and the engineers of several business machine companies

During the war the International Business Machines Corporation and the Bell laboratories built several large relay calculators, and IBM built and installed the famous Automatic Sequence Controlled Calculator (Mark I) at Harvard University in 1944 Meanwhile the first giant electronic calculator was being built at the University of Pennsylvania under wartime secrecy for the United States Army s Ballistics Research Laboratory It was called the ENIAC (Electronic Numerical Integrator and Calculator) Demonstrated to the public in February 1946 it created great interest because it could do remarkable things and was truly a giant machine, containing 18,000 vacuum tubes

Since the war, tremendous progress has been made Fifty organizations in the United States and 27 in other countries have built large electronic computers By 1953 there were 80 large-sized and about 2,000 medium-sized electronic computers in operation, the latter used primarily in conjunction with punched card machine installations Some giant computers have been given names for easy identification These include Remington Rand s UNIVAC (Universal Automatic Computer), the Bureau of Standard's SEAC (Standard's Eastern Automatic Computer), M I T 's Whirlwind Harvard's Mark IV IBM's 701, and the Institute of Advance Study Computer

The Analogue Class of Calculators

Devices using analogue computing principles can be seen everywhere For example, every clock has gear trains that perform the process of division The second-hand motion is divided by 60 to drive the minute hand, whose motion is again divided by 60 to drive the hour hand Water, gas, and electric meters have a set of dials labeled 1, 10, 100, 1,000, and so on which are connected to one another through a succession of gear trains that divide the motion of the previous dial by ten Gasoline pumps contain a complex analogue computer that automatically multiplies the price per gallon times the number of gallons to calculate the amount of money owed

Analogue computers are widely used in industry to control manufacturing processes and in military applications to control guns, tanks, ships, airplanes, and guided missiles. They are used in schools and laboratories to solve mathematical and engineering problems and to study and test complex control systems. Many colleges and universities are now offering courses on analogue and digital computers, and a knowledge of this field is important to young men who are planning to be engineers and scientists.

Examples of Analogue Computers

The slide rule is probably the most widely used of all computing devices. Many generations of engineering students have learned to use the "slip stick" in college. Logarithmic scales on this device make multiplication and division problems easy to solve (*see* Slide Rule).

The tide predictor, used by the United States Coast and Geodetic Survey, is an analogue computer. Data about the forces that influenced the tide at a particular port are fed into the machine. In about two hours, it produces a graph showing the rise and fall of tides at that port for the whole following year. *Network analyzers* have played an important role in the study of electric power systems. The systems to be analyzed are set up in miniature, using analogous units to represent the actual power stations, power lines, and loads. Measurements at various points on the model give the desired answers.

The Differential Analyzer, built at the Massachusetts Institute of Technology in 1930, is probably the most famous of the early analogue computers. It consisted of a maze of shafts, gears, plotting tables, and devices called "wheel and desk integrators." In the late 1930's, M.I.T. started the construction of another more elaborate and accurate machine, called the Rockefeller Differential Analyzer, which solved important wartime problems. It was unveiled to the public in October 1945. Many schools and laboratories have built similar machines for their own use.

Fire control computers, called gun directors, are used to aim and fire guns at hostile planes (*see* Navy). Anyone who has tried to shoot a rifle at a moving target can imagine the complexity of a computer required to aim a gun and hit a hostile plane 40,000 feet in the air and traveling at 500 miles an hour—and from the deck of a heaving and pitching ship.

Electronic analogue computers were developed by many organizations after World War II to aid in developing new weapons for defense and to solve engineering design problems. The Cyclone Computer and the Typhoon Computer, built by the Radio Corporation of America, and the ANACOM built by Westinghouse Corporation are examples of large-scale installations. Equipment of this class is now being manufactured commercially by several companies.

What Is Ahead?

Electronic computers have opened up new vistas in scientific frontiers. Now it is possible to extend human knowledge by mathematical calculations rather than by direct experiments.

A second industrial revolution is taking place in the factory where *automation* is the byword. (*See* Industry, American). Many developments are now under way to alleviate the boredom of routine tasks through electronics. The field of electronic computers presents a great promise and challenge to young people today.

CALCULUS. In nature and in science, we encounter many quantities which change as we deal with them. The amount of heat in a billet of steel begins lessening the instant the billet is poured from molten metal. The number of bacteria in a newly planted culture changes measurably every fraction of a second. So likewise does the direction of a planet's motion in space as it speeds along its orbit around the sun.

In such instances, we may want to know the *rate of change*. We may also want to know the rate as a basis for figuring the *amount* of change over a certain interval of space or time. The methods which solve these problems will determine areas or volumes embraced within curved lines or surfaces—a calculation that often cannot be made with arithmetic or algebra.

The mathematical methods which have been devised for dealing with such problems make up *calculus*. (The name, like our word "calculate," is from the Latin term meaning "pebble," from the ancient custom of using pebbles as counters in solving arithmetic problems.) A simple example will illustrate some of the fundamental ideas and terms used in calculus.

Calculus Uses "Functions" and "Variables"

The formula for the volume (V) of a sphere in terms of its radius r is $V=\frac{4}{3}\pi r^3$. This formula gives a definite relation between V and r since, for any value of r, the value of V is determined. For instance, if $r=3$ inches, then $V=36\pi$ cubic inches. Thus, the value of V may be thought of as depending on r. To express this idea, we say that *V is a function of r.*

In the formula, r and V are *variables* since each may have different values. The variable to which values are assigned freely is called the *independent* variable; the variable whose values are determined by those assigned the other is called the *dependent* variable.

If a specific formula is known which expresses the relation between one variable and another, the formula is spoken of as the *function*. However, a functional relation need not be given by means of an algebraic formula; it may be given by a table of corresponding values or by a graph.

Notation for Writing Functions

The fact that the volume (V) of a sphere in terms of its radius is $\frac{4}{3}\pi r^3$ may be indicated by *functional notation* as $V=f(r)$. In general, *the statement that y is a function of x is abbreviated to $y=f(x)$.* The "f" stands for the terms which define the relation. Thus, since $V=f(r)$ and $V=\frac{4}{3}\pi r^3$, we may use $f(r)$ interchangeably with $\frac{4}{3}\pi r^3$.

The notation $y=f(x)$ can be used conveniently to indicate that the values of y are to be considered which correspond to a particular value of x. For example, if $y=x^2-5x+6$, we may write

$$y=f(x)=x^2-5x+6$$

If we wish to find the value of y corresponding to $x=2$ we may replace x by 2 Then we have

$$y=f(2)=4-10+6=0$$

Similarly, if we wish to find the volume of a sphere with a 3-inch radius we replace r by 3 in the formula $V=f(r)=\frac{4}{3}\pi r^3$ and obtain $V=f(3)=\frac{4}{3}\pi\, 3^3$, or 36π cubic inches

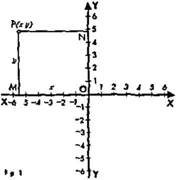


Fig 1

Graphs of Functions

Functions can also be represented by graphs using a system of *co-ordinates* (Fig 1)

Let X'X be a number line drawn horizontally with its positive direction to the right Let Y'Y be another number line drawn perpendicular to X'X so that the point of intersection is the origin on both lines Let the positive direction of Y'Y be upward The line X'X is called the X-axis and the line Y'Y is called the Y-axis the two lines together are called the *co-ordinate axes* The point of intersection O of the two lines is called the *origin*

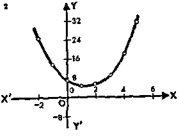
Let P be any point in the plane From P drop a perpendicular to the X-axis and another to the Y axis The perpendicular to the X axis cuts this axis at the point M which corresponds to the number x called the *abscissa* of P The perpendicular to the Y axis cuts this axis at a point N which corresponds to the number y called the *ordinate* of P The numbers x and y are called the *rectangular co-ordinates* of P To indicate that P has the co-ordinates x and y we write P(x y), and we refer to the point P as the point P(x y) or more briefly the point (x y)

When a function $y=f(x)$ is given by an algebraic formula for $f(x)$, we must first construct from the given formula a table of number pairs from which the points on the plane may be plotted We select a convenient number of pairs and plot the corresponding points Then a smooth curve drawn through these points is approximately the graph of the function

The method can be illustrated by plotting the graph of $2x^2-5x+7$ If we say that $y=f(x)=2x^2-5x+7$ we find for various values of x the corresponding values of the function as given in the table

x	y
-2	25
-1	14
0	7
1	4
2	5
3	10
4	19
5	32

Fig 2



We plot as many of these points as we need to define the curve and as can be located in the space available Connecting them in the order of increasing values of x by a smooth curve, we have the graph of Fig 2

The Nature of Analytic Geometry

In plane geometry problems are solved by constructions and by geometrical reasonings However a co-ordinate system as described above makes it possible to use algebraic processes (which usually are easier than geometric reasoning) for solving geometrical problems Thus algebra and geometry are united and the resulting subject is called *analytic geometry*

In analytic geometry certain geometric concepts such as point distance line angle and so on as well as geometric figures such as curves are expressed by means of algebraic symbols expressions and equations This creates a *geometry-algebra dictionary* Here are a few terms from such a dictionary

GEOMETRY ALGEBRA DICTIONARY

Geometry	Algebra
A point	$(x\ y)$
Distance between two points	$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
Slope of a line segment	$\frac{y_2-y_1}{x_2-x_1}$ or $\tan\theta$
Line through a given point and with a given slope	$y-y_1=m(x-x_1)$
Line through two given points	$\frac{y-y_1}{x-x_1}=\frac{y_2-y_1}{x_2-x_1}$

Problems Attacked by Differential Calculus

Functions are studied in the various branches of elementary mathematics such as algebra and analytic geometry These elementary divisions of mathematics however cannot provide satisfactory solutions for many problems that involve *rates of change* Some problems of this sort are raised by the following questions What is the best way of describing the speed of a car or the cooling of a hot object? How does the change of the plate current in a vacuum tube depend upon any change in the grid voltage?

In such problems the rate of change must be computed The methods used for doing so make up the divisions of mathematics called *differential calculus*

The Average Rate of Change

The solution of problems such as those mentioned start with finding the average rate of change For instance assume that a car starts a trip at noon and at 2 00 P M is 50 miles from the starting point At 5 00 P M it has gone 140 miles Obviously from 2 00 P M to 5 00 P M it traveled a distance of 140−50 *miles or 90 miles Since it did so in three hours it traveled* at an average rate of $\frac{90}{3}$ or 30 miles an hour

The distance s from the starting point is regarded as a function of the time t denoted by the symbol $s=f(t)$ We find that $f(2)=50$ and $f(5)=140$ The increment of t is $\Delta t=5-2=3$ and the incre-

ment of s is $\Delta s = f(2+\Delta t) - f(2) = f(5) - f(2) = 140-50=90$. Then:

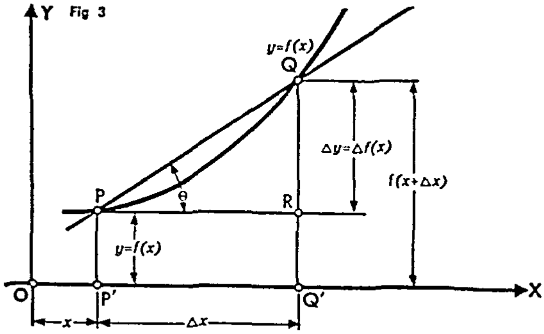
$$\frac{\Delta s}{\Delta t}=\frac{90}{3}=30 \text{ mph., the average rate}$$

This treatment of an average rate of change can be defined generally as follows: *the average rate of change of a function $y=f(x)$ in the interval from x to $x+\Delta x$ is defined as the ratio of the increments of y and x.* In symbols:

$$\frac{\Delta y}{\Delta x}=\frac{\Delta f(x)}{\Delta x}=\frac{f(x+\Delta x)-f(x)}{\Delta x}$$

A striking geometrical interpretation of the average rate of change can be given if the graph of the function is plotted. The function $y=f(x)$ may be represented by the graph of Fig. 3.

Fig 3



The increment Δx is given by the segment P'Q' = PR. The corresponding increment $\Delta y = \Delta f(x)$ is given by the segment RQ. Hence the average rate of change in the interval P'Q' is given by

$$\frac{\Delta y}{\Delta x}=\frac{RQ}{PR}=\tan\theta$$ (θ is angle between PQ and the direction of the X-axis)

Thus $\frac{\Delta y}{\Delta x}$ is the slope of the line PQ, and the *average rate of change* of the function $y=f(x)$ in the interval from x to $x+\Delta x$ is equal to *the slope of the straight line* PQ, which connects points on the graph that correspond to the values x and $x+\Delta x$. Such a straight line connecting two points on a curve is called a *secant* of the curve.

The average rate of change is computed very easily when the function is given by a formula. For example, to compute the average rate of change of the function $y=f(x)=3x^2-2$, if x changes from 1 to 3:

$$\Delta x=3-1=2$$
$$f(x)=f(1)=1$$
$$f(x+\Delta x)=f(1+2)=f(3)=3\cdot 9-2=25$$
$$\Delta y=\Delta f(x)=f(x+\Delta x)-f(x)=25-1=24$$
$$\frac{\Delta y}{\Delta x}=\frac{f(x+\Delta x)-f(x)}{\Delta x}=\frac{24}{2}=12$$

The Problem of "Instantaneous Rate"

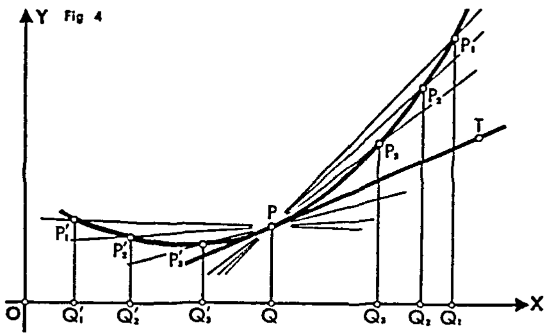
Many rate problems in practical life are not satisfactorily solved by merely computing an average rate of change of a function. If an automobile accident happens, the driver cannot shake his responsibility by proving that he drove at an average rate of 20 miles an hour during the preceding two hours. The important question is his *instantaneous* rate of speed at the *instant* of the accident, and especially if the rate happened to have been changing.

The precise meaning of an instantaneous rate therefore needs to be established. The same approach that defined an average rate does not work as well for defining an instantaneous rate. There is no interval of time that spreads over the instant of the accident and, likewise, no corresponding distance covered by the automobile. A definition can be reached, however, by "creeping up to it" from each side; that is, if the definition can be made increasingly sharper for ever-smaller intervals of time and distance traveled and the same is done for "afterward" by assuming that the automobile could have gone on, then there will be a certain set of values which separates everything "before" from everything "after." This set of values can be called a *limit*, and it will provide the desired instantaneous rate at the moment the accident occurred.

Geometrical Meaning of Instantaneous Change

This "limiting set of values" can best be illustrated in geometric terms that resemble those used with Fig. 3 for the average rate of change.

Fig 4



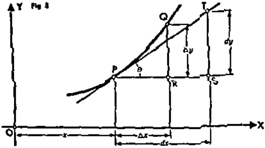
In a function given by the graph of Fig. 4, different points, P_1, P_2, P_3, and so on to the right of P are selected, and they establish the secants PP_1, PP_2, PP_3. Similarly, different points, P'_1, P'_2, P'_3, and so on to the left of P establish the secants PP'_1, PP'_2, PP'_3.

The *average* rate of change of the function for the segment QQ_1, for example, will be equal to the slope of the secant PP_1. Other secants define other average rates. The figure shows, however, that one line, PT, separates the secants meeting the curve to the right of P from those meeting to the left. This line is called the *tangent* of the curve at P.

The slopes of secants on either side of P approach the slope of the tangent as the defining points are taken nearer and nearer to P. Therefore we may say that the slope of the tangent at P is *the limit of the slopes of the secants* through P as the defining points approach nearer and nearer to P. If the slopes of the secants define *average* rates of change

on either side of P however then the slope of the tangent must be the *instantaneous* rate *at* P We can say therefore that *the instantaneous rate of change at P is equal to the slope of the tangent at P*

In order to find the slope of the tangent take a freely chosen point T on the tangent (Fig 5)



The increments of the co-ordinates if one passes from P to T may be denoted by dx and dy The slope (angle θ from the horizontal) of the tangent PT therefore is $\tan\theta=\frac{dy}{dx}$

It was stated above however that the instantaneous rate of change at the point P which may be denoted by m is equal to the slope of the tangent PT We then have an expression for the value of m $m=\frac{dy}{dx}$

Since the instantaneous rate of change was defined as the limit (lim) of the average rate of change for the interval Δx as Δx approaches zero we also have

$$m=\lim\frac{\Delta y}{\Delta x} \text{ as } \Delta x\to 0$$

Therefore the *derivative* (or instantaneous rate of change) of a function $y=f(x)$ at a particular point P is the value of $\lim\frac{\Delta y}{\Delta x}$ as Δx approaches zero This value is equal to the slope of the tangent at P If dx and dy are increments of x and y from P to a freely chosen point on the tangent then the derivative at P is given by

$$\lim\frac{\Delta y}{\Delta x}=\frac{dy}{dx}$$

The Formula for a Derivative

To show how to find the derivative of a function which is defined by a formula consider the function

$$y=f(x)=3x^2-5$$

To find the derivative of this function at some particular point (for example $x=2$) first find the average rate of change in the interval from $x=2$ to $x=2+\Delta x$ This can be done as follows

$$f(2)=3 \quad 2^2-5=3 \quad 4-5=12-5=7$$
$$f(2+\Delta x)=3(2+\Delta x)^2-5=7+12\quad\Delta x+3\quad(\Delta x)^2$$
$$\Delta y=f(2+\Delta x)-f(2)=12\quad\Delta x+3\quad(\Delta x)^2$$
$$\frac{\Delta y}{\Delta x}=12+3\quad\Delta x$$

The next step is to find the limit of the average rate of change $\frac{\Delta y}{\Delta x}$ as $\Delta x\to 0$ We then have

$$\lim\frac{\Delta y}{\Delta x}=\lim(12+3\quad\Delta x)=12 \text{ as } \Delta x\to 0$$

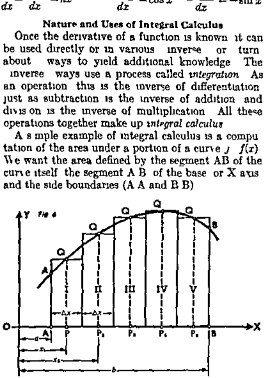
Such a computation of a derivative applies to any *power* function of x—that is x with any exponent thus x^n A formula for problems in x^n is as follows (together with other important derivatives)

$$\frac{dy}{dx}=\frac{d(x^n)}{dx}=nx^{n-1} \qquad \frac{d\sin x}{dx}=\cos x \qquad \frac{d\cos x}{dx}=-\sin x$$

Nature and Uses of Integral Calculus

Once the derivative of a function is known it can be used directly or in various inverse or turn about ways to yield additional knowledge The inverse ways use a process called *integration* As an operation this is the inverse of differentiation just as subtraction is the inverse of addition and division is the inverse of multiplication All these operations together make up *integral calculus*

A simple example of integral calculus is a computation of the area under a portion of a curve $y=f(x)$ We want the area defined by the segment AB of the curve itself the segment A B of the base or X axis and the side boundaries (A A and B B)



Divide the base into segments of length Δx and upon these segments erect rectangles with heights P Q P_2Q_2 and so on The area of each rectangle will be its base Δx multiplied by the height The sum of these areas will be

$$\text{I}+\text{II}+\quad-(P_1Q)\Delta x+(P_2Q_2)\Delta x+ \qquad (1)$$
$$-f(x_1)\quad\Delta x+f(x_2)\quad\Delta x+ \qquad (2)$$

This sum obviously gives an approximate value for the area ABB A The area can be found with any desired degree of precision by taking a large enough number of segments (rectangles) The expression (2) above can be abbreviated by using symbols as follows $Sf(x)\Delta x$

Here the symbol S signifies that a series of similar terms—$f(x_1)$ Δx $f(x_2)$ Δx and so on—is to be added In order to show that the area can be found as precisely as we desire by taking Δx small enough

we use the symbol dx instead of Δx, and the symbol $\int$ (read as "the integral of") instead of S

$$\text{Area ABB'A'} = \int f(x)dx$$

In order to indicate that the area bounded by the lines $x=a$ and $x=b$ is to be computed, we write

$$\text{Area} = \int_a^b f(x)dx$$

The right-hand member of this equation is called the *definite integral* of $f(x)dx$ between the limits a and b (or it can be said, "from a to b").

Integration as the Inverse of Differentiation

From this stage, we must find a way to obtain an *exact* value, in algebraic terms, for the definite integral. This value can be computed, because a great mathematical discovery tells us that if the $f(x)$ in the integral is considered *as a derivative of some other function*, that other function will provide the basis for the desired answer.

This can be done readily for simple functions. If the curve which helps define the desired area, for example, is $y=x^2$, the integral (in part) will be

$$\int f(x)dx \text{ or } \int (x^2)dx$$

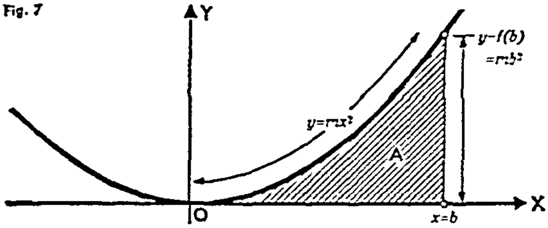
The problem now is to discover "what other function" will yield x^2 as a derivative. Knowledge of differentiation tells us that "the other function" can only be $\frac{x^3}{3}$. (Under the rule for differentiating a power function in which n is 3, the derivative is $\frac{3x^2}{3}$, or x^2.) This reasoning can be "turned around" by using n for 2, 3, or any other exponent and saying that "the integral (in part) of x^n is $\frac{x^{n+1}}{n+1}$."

The final step in applying the result above (use of $\frac{x^3}{3}$ for x^2 in the integral) is evaluating

$$\int f(x)dx \text{ between } a \text{ and } b \left[= \int_a^b (x^2)dx \right]$$

Mathematicians have proved that this can be done for a definite integral by subtracting the lesser value (at $x=a$) from the greater (at $x=b$). For a simple example, use the parabola $y=mx^2$ (Fig. 7). Since the parabola cuts the co-ordinate axes (X and Y) at their origin (O), the value of a can be considered 0 and we need only deal with the value $x=b$.

Fig. 7



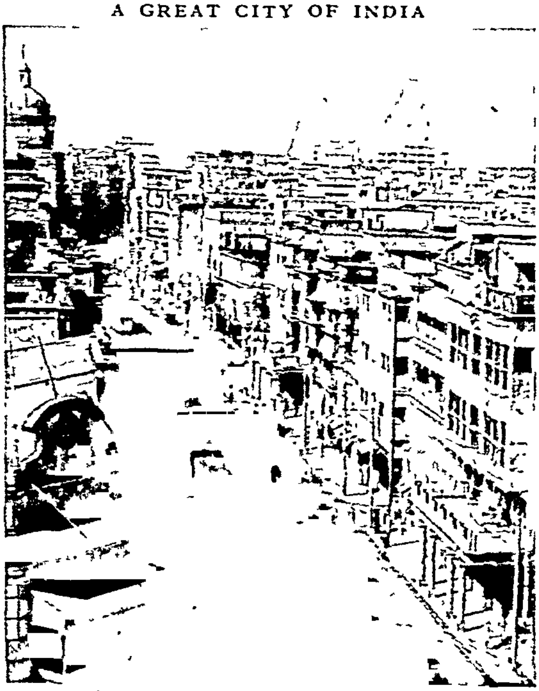
The area A can now be obtained immediately by substituting b for x in the partial solution $\frac{x^3}{3}$ obtained above as follows:

$$\int_a^b f(x)dx = \int_0^b (mx^2)dx = \left[\frac{mx^3}{3}\right]_0^b = \frac{1}{3}mb^3$$

The Constant of Integration

In many problems $f(x)dx$ is given without limits. It is to be evaluated over its entire range. Evaluation depends upon this fact: the derivatives of both x^2+2 and x^2+3 will be $2x$ since the derivative of any constant (such as 2 or 3) is 0. In using $\frac{x^3}{3}$ for integrating x^2dx, the possible existence of a constant with $\frac{x^3}{3}$ (a constant which would "disappear in differentiating") is recognized by writing $\frac{x^3}{3}+C$. C is called the *constant of integration*; the result, an *indefinite integral*, because its value depends in part upon whatever value the constant C may have.

A GREAT CITY OF INDIA



A great bridge reaches westward across the Hooghly River to Calcutta's large suburb, Howrah. Calcutta is India's second largest city and one of its two important ports.

CALCUTTA, INDIA. Its position on the Ganges River delta has made Calcutta a great clearinghouse for Asiatic trade and India's second largest city. The city spreads five miles along the east bank of the Hooghly River, the westernmost branch of the Ganges, about 80 miles upstream from the Bay of Bengal. The Hooghly, a quarter to more than three quarters of a mile wide, is navigable for ocean vessels. Calcutta is the capital of West Bengal Province (East Bengal is a province of Pakistan).

The Port of Calcutta commission controls wharves and docks along some ten miles of the banks on both sides of the river, including those of Howrah, an in-

dustrial suburb on the west bank. The terminals of the rail lines reaching Calcutta from the west lie in Howrah. The suburb (population 433,630) is connected to Calcutta by bridges.

A great park called the Maiden stretches a mile and three quarters along the city's southern river bank. Beautiful drives, botanical gardens, and sports fields are found in the park. To the east of the Maiden is Calcutta's finest residential district. The Strand, a wide roadway, runs along the city's whole river front.

Along the Esplanade, a street to the north of the Maiden, lie Government House, built between 1799 and 1804, and other government buildings. Government House was the residence of the viceroy of India until India's capital was moved to Delhi in 1912. More government buildings are found on the widening of Canning Street called Dalhousie Square. Calcutta has a large university, established in 1857, and several colleges. A notable art museum exhibits many rare and beautiful relics of the past.

Calcutta has many fine buildings, including the Victoria Memorial, but the houses in the poorer districts in the city and suburbs are little more than mud huts. The city's manufactures are mostly burlap made from jute grown in both East and West Bengal, and metal goods. Rail workshops also employ large numbers of workers. The chief exports are jute and jute goods, coffee, tea, grain, cotton, raw hemp, and rubber; the chief imports are cotton goods, sugar, machinery, petroleum, railroad equipment, and salt.

The city was founded on the sites of several Indian villages by Job Charnock, of the British East India Company, in 1690. The company concentrated its administrative activities in Fort William, built here in 1696. Fort William was captured and destroyed in 1757 by the Nawab of Bengal, Siraj-ud-daula. The Black Hole tragedy occurred on a hot June night when 146 Britons were forced into a cell that measured only 18 by 14 feet. The next morning only 23 remained alive. About a year later Robert Clive defeated the Nawab at Plassey (*see* Clive).

Clive's victory gave all Bengal to the British. In 1772 Hastings (*see* Hastings, Warren) made Calcutta the capital of British India. The removal of the capital to Delhi was announced in 1911. (*See* India.) Population (1951 census), 2,548,677.

CALDECOTT, RANDOLPH (1846–1886). Because he had great talent and loved horses, dogs, and everything that belonged to the English countryside, Randolph Caldecott drew pictures of them as few artists have done. He was born in the old walled city of Chester in England on March 22, 1846. Randolph and his brother attended the King's School in Chester and the school record says that Randolph Caldecott was head boy of the school.

From the time he was a small boy, Caldecott was always drawing pictures of animals and modeling them. He wanted to study art but his father disapproved. So when Randolph was 15, he went to work in a bank at Whitchurch in Shropshire and lived in an old farmhouse just outside town. He went fishing and shooting, to meets of the hounds, to market, and to cattle fairs. Always he carried a sketch book ready to catch notes for a picture.

After six years at Whitchurch, Caldecott was transferred to a bank in the city of Manchester, where he made the most of what a big city had to offer. He joined a club of artists and writers, studied nights at art school, and made many friends. This came easily because Randolph Caldecott had great personal charm.

His first published drawings appeared in two Manchester papers, *The Will o' the Wisp* and *The Sphinx*. Meanwhile, he was making hunting sketches for a paper called *London Society* and carrying on his work at the bank. His bank associates told amusing stories about finding sketches of horses, dogs, and the like on old receipt slips, envelopes, and desk blotters.

In 1872 Caldecott gave up his bank work and moved to London. He studied art under various teachers and devoted the rest of his life to drawing pictures.

Henry Blackburn was editor of *London Society*, and he and Caldecott became lifelong friends. Among the many good things that grew out of this friendship were two trips abroad. They worked together on books of travel in Brittany and the Harz Mountains of Germany. Some of Caldecott's Harz Mountain sketches were published in the *London Graphic*. Occasionally, he put himself in the picture—a tall, slim young man with whiskers.

SKETCHING UNDER DIFFICULTIES

Randolph Caldecott sketched this amusing self portrait during a tour of Brittany. He loved to have children around him as he worked.

Caldecott's drawing was free and alive. He studied the art of "leaving out" as a science, doing nothing hastily but thinking long and seriously before putting pen to paper. He always said: "The fewer the lines, the less error committed!"

The summers between 1872 and 1874 he spent at Farnham Royal in Buckinghamshire making drawings for a book 'Old Christmas'. This book was made of chapters from Washington Irving's 'Sketchbook'. He loved the same things about old England that Washington Irving had loved a generation before and he gave them fresh life through his pictures. Later, he made illustrations for a sequel called 'Bracebridge Hall'.

Although Randolph Caldecott never had children of his own, he had scores of children as friends. He drew pictures for them and never failed to answer their letters. "I thank you very much for your grand

sheet of drawings," he wrote one aspiring young artist. "I hope you will go on trying and learning to draw. There are many beautiful things waiting to be drawn. Animals, flowers . . . and a few people."

It was for children that he did the work for which he will probably be longest remembered and best loved —his picture books. The 'Three Jovial Huntsmen', 'A Farmer Went Trotting upon His Grey Mare', and 'John Gilpin' were rhymes after his own heart. England in springtime seems to be on every page of 'The House That Jack Built', 'The Farmer's Boy', and the old May Day ballad, 'Come Lassies and Lads'. 'The Queen of Hearts', 'A Frog He Would a'Wooing Go', and 'Sing a Song for Sixpence' contain enough pictures of blackbird pies, jam tarts, pots of honey, and frosted cakes to make anybody's mouth water.

On March 18, 1880, Caldecott and Marian Brind were married in a small church in Kent. They went to live in a house near Sevenoaks, a house with a garden where he could indulge his love for the country. "I have a mare," he wrote a friend, "dark chestnut, who goes very well in harness and is very pleasant to ride; and a puppy, a comical young dachshund." For some time, he had been in poor health, and in 1886 he and his wife sailed for America, hoping that the warm climate of Florida might benefit him.

He promised the *London Graphic* a series of sketches on American life, and what fun he would have had doing them. But the stormy sea voyage had exhausted him too greatly. He died in St. Augustine, Fla., on Feb. 12, 1886, and was buried in Evergreen Cemetery there. In the Chester Cathedral is a tablet in his memory, and many of his original sketches are in the Manchester Art Gallery and the Print Room of the British Museum. The Caroline Miller Parker Collection of the Houghton Memorial Library of Harvard University has many of Caldecott's notebooks, first editions, personal letters, and original drawings.

CALENDAR. For untold centuries people have kept track of the days by the march of daylight and darkness and of the changing seasons in order to know when to plant crops and get ready for winter. Sometimes they kept the record by notching a stick or knotting a cord once every day. They also watched the changing positions of the sun and stars in the sky, the changes of the moon, and the habits of plants and animals. South American tribes expected spring when the Pleiades rose. North American Indians planted corn when oak buds were the size of a squirrel's ear. The Greek poet Hesiod warned against digging in vineyards once snails climbed the plants.

The making of an exact calendar, however, has perplexed men for ages because the divisions of time, by days, months, and years do not fit together. These inequalities are explained in the article Year.

The Sumerians of Babylonia were probably the first people to make a calendar. They used the phases of the moon, counting 12 lunar months as a year. To make up for the difference between this year and the year of the seasons, they inserted an extra month in the calendar about every four years.

The early Egyptians, the Greeks, and the Semitic peoples copied their calendars from the Babylonians. Later, the Egyptians worked out a calendar that corresponded almost exactly to the seasons. The Jews and Mohammedans, however, still use a lunar calendar.

Like the Greeks, the early Romans used a calendar based on the moon. The year was only 355 days long. The months corresponding to March, May, July, and October each had 31 days; February had 28 days; and the rest had 29. An extra month was added about every fourth year.

The high priest regulated the calendar. On the *calends*, or day of the new moon, he announced to the people the times of the *nones* (first quarter) and *ides* (full moon) for that month. We get our word *calendar* from the Latin word *kalendae*.

But the priests performed their calendar-keeping duties poorly, and by Julius Caesar's time they had summer months coming in the spring. Caesar corrected this situation in 46 B.C. He adopted the plan of the Egyptian astronomer Sosigenes to have 365-day years, with one extra day added every fourth year or "leap year." He distributed the extra ten days among the old 29-day months, making them identical with our months.

The month Quintilis was renamed July for Julius Caesar, and later Sextilis was renamed August in honor of Emperor Augustus. An old story which is often repeated tells how Emperor Augustus changed the number of days in his month from 30 to 31 so that it would be as long as Julius Caesar's. The story, however, probably has no basis in fact.

The Gregorian Calendar

Julius Caesar's correction of one day in four years (¼ day, or six hours, a year) made the calendar year longer than the year of the seasons. Thus anniversaries began coming earlier and earlier in the year. In 1582 the vernal equinox occurred on March 11 instead of the correct date March 21.

Pope Gregory XIII remedied this by directing that ten days be dropped from the calendar, and that the day after October 4, 1582, should be October 15. He also directed that three times in every 400 years the leap year arrangement should be omitted (*see* Year).

The new calendar was called the Gregorian, or New Style, calendar. It was adopted almost immediately by Roman Catholic countries, but Protestant and Eastern Orthodox countries long continued to use the Old Style, or Julian, calendar. The new calendar was not adopted in England until 1752, when it was necessary to drop 11 days. Ignorant people resented this change; they held great meetings and went about in processions crying: "Give us back our 11 days!" The Eastern Orthodox church did not accept the New Style until 1923, when 13 days were "lost." The Chinese adopted it in 1929.

Another reform which the Gregorian calendar effected was general adoption of January 1 as the beginning of the year. Until then some nations began it with December 25, others with January 1, or March 25 (as England did before 1752).

This change explains why *documents of the 18th century frequently give dates in Old and New Style* For instance, George Washington was born Feb 22, 1732, N S, or Feb 11, 1731, O S, because the Old Style year began in March Sometimes this is written Feb $\frac{11}{22}$, 173$\frac{1}{2}$ The Pilgrims landed at Plymouth on *Dec $\frac{11}{21}$, 1620 According to Governor* Bradford, they began to erect the first house on Dec 25, 1620, O S In the New Style calendar this was Jan 4, 1621

Numbering the Years

Events and the lives of kings and prophets have been used by calendar makers to start their reckonings The Greeks dated everything from the beginning of the so-called Olympic Register, a traditional list of the victors in the Olympic games The year was 776 B C, according to our reckoning The Romans counted time from the founding of their city (753 B C) The Mohammedans reckon dates from the 'Hegira" or flight of Mohammed from Mecca, in A D 622 Jews reckon from the creation of the world, which they place at 3761 B C The anticlerical French Revolutionary calendar (1793–1806) was dated from the birth of Liberty (1792) and had a ten-day week.

The Egyptians instead of dating the successive years from a single event, named each year after its *most important happening Later they numbered the* years of each king's reign from his accession to the throne Some Indian tribes named their years by picturing on skins the "small pox used them up-again" winter, the "storm of stars" winter, and the like

The Christian Era

Christian nations now date events from the birth of Christ This practise began in the 6th century, when *Dionysius Exiguus, a Roman abbot introduced it into* Italy Now scholars claim that Christ was born a few years earlier than the date used for the era

In reckoning time before the Christian Era (marked B C), the *longer ago* an event occurred, the larger is *the number of the year For instance,* the year 150 B C was 100 years *before* 50 B C, but the year A D 150 (Anno Domini), or after Christ, was 100 years *after* A D 50, because we count forward We also divide *time before and after the birth of Christ into periods* of 100 years, or centuries Thus the years between the birth of Christ and A D 100 are in the first century, from A D 100 to 200 are in the 2d century, and so on The years between *1900 and 2000 are in the* 20th century In reckoning time before the birth of Christ we count the centuries back from that event

Modern Proposals for Calendar Reform

Because the Gregorian calendar has uneven *months* many groups have advocated reform The great-

A PERPETUAL CALENDAR AND HOW TO USE IT

Table of Letters

16 20	A	G	F	E	D	C	B
17 21	C	B	A	G	F	E	D
18 22	E	D	C	B	A	G	F
19 23	G	F	E	D	C	B	A
							00
	00	01	02	03	04		05
	06	07	08		09	10	11
	12		13	14	15	16	
	17	18	19	20		21	22
	23	24		25	26	27	28
		29	30	31	32		33
	34	35	36		37	38	39
	40		41	42	43	44	
	45	46	47	48		49	50
	51	52		53	54	55	56
		57	58	59	60		61
	62	63	64		65	66	67
	68		69	70	71	72	
	73	74	75	76		77	78
	79	80		81	82	83	84
		85	86	87	88		89
	90	91	92		93	94	95
	96		97	98	99		

Calendar of Dates in Each Month

A	Su	M	Tu	W	Th	F	Sa
B	Sa	Su	M	Tu	W	Th	F
C	F	Sa	Su	M	Tu	W	Th
D	Th	F	Sa	Su	M	Tu	W
E	W	Th	F	Sa	Su	M	Tu
F	Tu	W	Th	F	Sa	Su	M
G	M	Tu	W	Th	F	Sa	Su
JAN	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31				
FEB				1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	(29)			
MAR.				1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29	30	31	
APR.							1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30						
MAY		1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30	31			
JUNE					1	2	3
	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	

A	Su	M	Tu	W	Th	F	Sa
B	Sa	Su	M	Tu	W	Th	F
C	F	Sa	Su	M	Tu	W	Th
D	Th	F	Sa	Su	M	Tu	W
E	W	Th	F	Sa	Su	M	Tu
F	Tu	W	Th	F	Sa	Su	M
G	M	Tu	W	Th	F	Sa	Su
JULY							1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	31					
AUG			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31		
SEPT						1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
OCT	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31				
NOV				1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29	30		
DEC.						1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24/31	25	26	27	28	29	30

This *perpetual calendar* will tell the day *of the week* for any date within a span of 800 years—from 1600 to *2399* To use it first find the key called the *dominical letter* in the table above at the left

For a common year (not a leap year) look along the *horizontal rows at the top and find the first two numbers* of the year you want Then look up the vertical columns for the last two numbers Now notice where the row containing the first two numbers and the column containing the last two numbers cross In this *square is the dominical letter for that year*

Now use the calendar at the right to find the day of the week Locate the horizontal row at the top labeled with the correct dominical letter Then find the vertical column in which the proper date appears Where *the row and column cross is the day of the week for that* date

For leap years you will find dates in January and February as just explained for common years But for the other months a special dominical letter is needed Notice that the last two numbers of a leap year are followed by a blank space in the vertical columns Go up from this blank space to the horizontal row to find the special dominical letter Then proceed as before For dates after February in 1600 or 2000 use the right hand column where 00 appears in heavy type

est benefit with the least change seems to be offered by the World Calendar. This calendar proposes to keep the 12-month year, but to change the number of days in certain months so that the four quarters of the year are equal. Each quarter would begin on a Sunday and end on a Saturday, and most of the time-honored holidays would come conveniently at the beginning or end of the week.

A 13-month calendar was long favored by many. It, however, could not be divided into equal quarters, and its adoption would involve so many changes that popular acceptance would be slow.

The Popular Almanacs

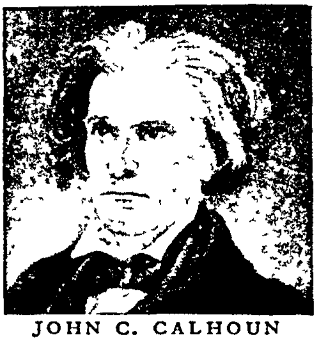
A few generations ago, almost the only literature in countless families were almanacs. They contained calendars, lists of festivals, proverbs, bits of knowledge, homely remedies, and common superstitions. Benjamin Franklin's *Poor Richard's Almanack*, first published in 1732, is famous for its wise sayings. The United States Naval Observatory publishes a nautical almanac, giving detailed information useful to navigators. The *Almanach de Gotha*, written in French and German, with accounts of royal and noble families, was printed from 1763 to 1945. The almanac makers of 16th-century France foretold state events, like the death of Henry II, but soon were forbidden to publish such predictions. Unchecked bold prophecies and popular errors filled 17th-century English almanacs. Square blocks of wood, metal, or horn, with notches representing days, used in earlier times and called clog almanacs, are thought to be of Danish origin. The Romans had *fasti*, or tables, of the months, lawful and unlawful days, festivals and the like, which only the priests understood before they were explained to the people in 304 B.C.

CALGARY, ALBERTA. Western Canada's cattle and wheat-ranching center is beautifully situated at the junction of the Bow and Elbow rivers. Rolling prairie and low hills surround it. In the distance loom the snowy peaks of the Rocky Mountains.

Calgary is the shipping and distributing point for an immense cattle-raising and wheat-growing district, and the chief supply station for the coal mines of the eastern Rockies. It is also an important railway center, since it lies near the entrance to two passes through the Rockies. The Turner Valley oil field is 40 miles distant, and there are many refineries in the city. Stockyards, meat-packing plants, flour mills, grain elevators, a large nitrogen plant, and a railway repair plant are other establishments. Hydroelectric power is supplied by the Bow River. Natural gas, piped from Turner Valley, is used for all domestic heating, as well as for industrial purposes.

In 1875 the site of Calgary was selected for a Royal Canadian Mounted Police fort. Growth began with the coming of the Canadian Pacific Railway in 1883, and the city was incorporated in 1893. It has a substantial appearance not often found in the "boom" towns of the West. This is because the early buildings were constructed largely of gray sandstone which was quarried in the neighborhood. On St. George's Island in the Bow River is a 45-acre wooded park. In Victoria Park is held the Calgary Stampede, a rodeo which every July re-creates the romance of the old wild west. The Reader Rock Garden and the Inglewood Game-Bird Sanctuary are other points of interest. In Calgary are the Institute of Technology and Art and a branch of the Faculty of Education of the University of Alberta. Population (1951 census), 129,060.

CALHOUN, JOHN CALDWELL (1782-1850). Born in the same year as Daniel Webster and dying two years before that great statesman, Calhoun stood at the opposite pole of politics from Webster—the defender of the South, as Webster was of the North. He was successively member of Congress at the time of the War of 1812, secretary of war under President Monroe, vice-president with John Quincy Adams and with Andrew Jackson, secretary of state under President Tyler, and for many years senator from South Carolina.



JOHN C. CALHOUN
Champion of States' Rights

Calhoun was a son of the South Carolina hills. Born of Scottish parents on a frontier farm near Abbeville, he was left fatherless when very young and received little early education. It is said that he seldom laughed and had no sense of humor. In 1800 he entered the Junior class at Yale College. He was graduated two years later with highest honors. After a brief term in his state legislature, he was elected in 1811 to Congress.

Here, with young Henry Clay, he became a leader of the "War Hawks," who were urging war with England. When their combined eloquence finally brought war in 1812, Calhoun advocated vigorous measures. When the war was over he continued to urge the use of wide national powers. He also favored a protective tariff, a national bank, and a strong army and navy.

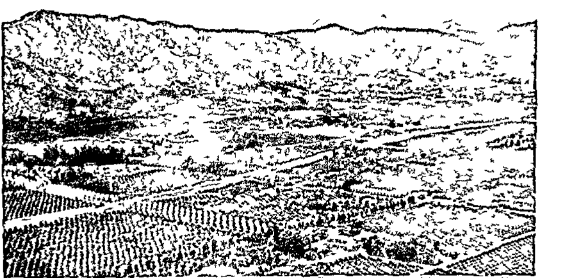
But during the next 12 years a change took place in Calhoun's views. The ardent nationalist became the no less ardent champion of States' Rights. In 1828 the cotton-growing states of the South, especially South Carolina, were furious at what they bitterly called the "tariff of abominations," a tariff which they claimed levied tribute on the South for the benefit of manufacturing New England. Calhoun wrote a paper called the 'South Carolina Exposition', in which he urged that the protective tariff of 1828 was unconstitutional. He argued also that any state had the constitutional right to refuse obedience to the law and to declare it null and void within its limits. When South Carolina tried to put his idea of nullification into practise late in 1832, Calhoun, who was vice-president at the time, resigned to enter the Senate and lead the fight against the President's policies. The stern and resolute attitude of Jackson,

combined with a compromise tariff put forth by Henry Clay prevented an armed clash Calhoun and Jackson became bitter enemies

It was impossible to espouse the cause of the South and not uphold the institution of slavery Accordingly as the years passed by Calhoun from merely tolerating slavery became its strongest defender In order to extend slave territory Calhoun when secretary of state under Tyler negotiated a treaty for the annexation of Texas although he greatly deplored the war with Mexico which followed

To the end of his life Calhoun was untiring in defense of his beloved South In the debate on the Compromise of 1850 he made his last public appearance He was so ill that he had to be carried into the Senate Chamber and so weak that his *speech had* to be read by a colleague Within less than a month he passed away Almost his last words were the South—the poor South God knows what will become of her now Daniel Webster one of his chief political opponents during the 40 years of his public life said of him what no historian would deny He was a man of undoubted genius and commanding talent He had that indispensable basis of high character—unspotted integrity and unimpeachable honor But his great abilities were used to bolster up an institution which was both morally and politically wrong—the institution of human slavery

The RICHES *of the* GOLDEN STATE



This scene is typical of the fertile valleys throughout much of California Without irrigation many of these valleys would become grassless deserts The air view *was taken near Glendo*ra located in Los Angeles County in the Southwestern part of the state Notice the well ordered groves of oranges and lemons In the distance rises Mount San Antonio popularly called Old Baldy It is the highest peak in the San Gabriel Mountains

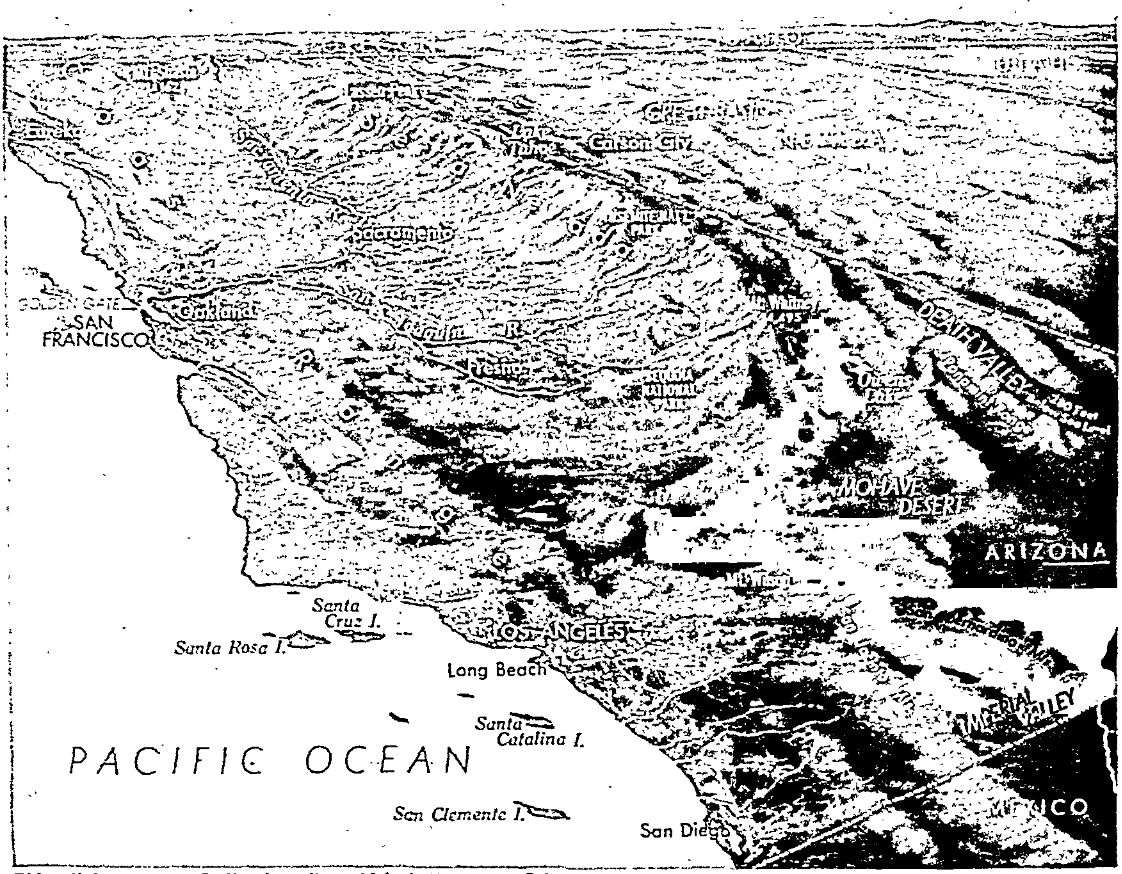
CALIFORNIA The story of the Golden State began as a romance and dramatic episodes have marked its development ever since A Spanish writer of 16th-century adventure tales Ordonez de Montalvo described a fabled island called California in a book entitled The Deeds of Esplandian published in 1510 He described the fabled California as an island full of pearls and gold lying to the right of the Indies close to the terrestrial paradise When Cortez or some other Spanish explorer discovered the land he may have named it *California* believing it to be the island described earlier by Montalvo

Others believe the state is named from *caliente forno* ("hot furnace") referring to the deserts in Lower California But it cannot be denied that the lure of California wealth has dominated the history of the state since its discovery Pearls and gold were the lodestones that sent the Spaniards in search of California in 1542 and the discovery of gold near San Francisco about 300 years later drew the first mass immigration of Americans

Since then the gold of sunshine oranges and poppies and the rich opportunities in agriculture and industry have attracted ever greater streams of people to the state Among them are tourists businessmen and retired persons who firmly believe that this is indeed the terrestial paradise

Contrasting Aspects of California

California is the second largest state in the Union and it is as varied as it is vast It has lush fruit groves forests with the world s tallest trees and some of the grimmest deserts Temperatures range from searing heat matching that of the Sahara to perpetual Arctic chill on mountain tops Rainfall varies from a drenching 100 inches a year to almost none In many localities rivers start bravely, then creep



This relief map shows California as it would look if we were flying high above San Diego, where the first Spanish settlement was made. We would see its two great mountain ranges with the Great Valley between, drained by the Sacramento and San Joaquin rivers. We would see San Francisco Bay and the Golden Gate, the only break through the Coast Ranges into the interior; Mount Whitney, the highest point in the United States, and Death Valley, the lowest point. We would see Los Angeles and the great harbor it shares with Long Beach; and in the southeast, the bleak Mohave Desert. The Imperial Valley, once equally arid, now a fabulously rich fruit and vegetable garden, is irrigated by the waters of the Colorado River.

stealthily beneath gravel beds, to appear occasionally on the surface and finally lose themselves in the salt flats. Less than 100 miles from Mount Whitney, the highest point in the United States proper (14,495 feet), is Death Valley, the lowest point in the country (282 feet below sea level).

Up and down the middle of the state runs the Great Valley with its endless pattern of factory-like ranches, where rows of lettuce may extend with machine precision for miles. Elsewhere are lovely little gemlike basins, mountain-girdled and ablaze with blossoming orchards and acres of flowers. In the north lava beds lie flung in wild disorder, black masses of rope-like rock, jagged, pocked, treacherous, in surly rebellion against the beauty of the white volcanic cones towering in the distance. And all the western coast is white with the surf of the blue Pacific.

Most of the eastern boundary is a spectacular mountain range, the Sierra Nevada, 400 miles long, and 50 to 80 miles wide (*see* Sierra Nevada). Many of the peaks along the jagged, snowy crest are more than 14,000 feet high, vying with Mount Whitney. On the west, the low Coast Ranges slope down to the Pacific Ocean. These are parallel ridges, 2,000 to 4,000 feet high, which trend from northwest to southeast. Between them lies many a valley open to the sea at its northwest end, but mountain-locked at the other. The only break into the interior is the Golden Gate and San Francisco Bay, through which the rivers of the Great Valley empty their waters.

The Great Central Valley

In its vast cradle between the Coast Ranges and the Sierra Nevada this Great Valley (or Central Valley as it is also known) forms a flat, elliptical trough, 450 miles long and averaging 50 miles in width. In terms of eastern mileage it extends as far as from Chicago to Memphis, Tennessee. Its origin is linked with the mountains enclosing it. It is a great fold in the earth's crust, which sank as the mountains rose. Sand, gravel, and silt, carried down from the mountains by streams, filled in the bottom of the trough to a great depth, making the valley

Continued on page 57

California Fact Summary

CALIFORNIA (Calif) May have been named by Cortez from a 16th century Spanish novel The Deed of Espland an by Montalvo or from *caliento forno* (hot furnace) referring to deserts in Lower California
Nickname Golden State from gold found there also Grape State
Seal: Minerva with the Golden Gate a bear and a ship in full sail in foreground Sierra Nevada in back ground motto written above this scene
Motto Fureka (Greek for I Have Found It)
Flag For description and illustration see Flags
Flower: Golden poppy **Bird:** California valley quail **Tree** California redwood **Song** I Love You California — words F B Silverwood music A F Frankenstein

THE GOVERNMENT

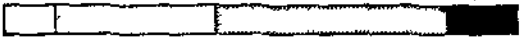
Capital: Sacramento (since 1854)
Representation in Congress Senate 2 *House of Representatives* 30 *Electoral votes* 32
State Legislature: Senators 40 term 4 yrs Assemblymen 80 term 2 yrs Regular session meets 1st Monday after Jan 1 in odd years limited to 120 calendar days Budget session 1st Monday after March 1 in even years limited to 30 calendar days
Constitution Adopted 1879 Proposed amendment may be (a) passed by two-thirds majority of legislature or by initiative action of the people and (b) ratified by a majority voting on amendment at a popular election
Governor Term 4 years May succeed himself
Other Executive Officers Lieut gov sec of state atty gen , treas controller all elected terms 4 yrs
Judiciary Supreme court—7 justices elected at large term 12 years District courts of appeal—4 districts divided into 7 divisions with 3 judges each judges elected term 12 years Superior courts—1 in each county judges elected term 6 years Judicial council *includes chief justice and 10 judges appointed* by him duties to speed up court s business
County 58 counties each governed by a board of supervisors—usually 5 members elected term 4 years
Municipal Mayor and council most common some have commissioners directors city managers or trustees
Voting Qualifications Age 21 residence in state 1 year in county 90 days in precinct *54 days Literacy test* Voter must be of sound mind a citizen and registered

TRANSPORTATION AND COMMUNICATION

Transportation Railroads 7 500 miles First railroad Sacramento to Folsom 1856 Rural roads 97 700 miles Airports 510
Communication Periodicals 395 Newspapers 748 First newspaper *Californian* Monterey 1846 Radio stations (AM and FM) 185 first station KQL Los Angeles licensed Oct 13 1921 Television stations 19 first station KTLA Los Angeles began operation Jan 22 1947 Telephones 4 053 000 Post offices 1 439

THE PEOPLE AND THEIR LAND

Population (1950 census) 10 586 223 (rank among 48 states—2d) urban 80 7% rural 19 3% Density 67 5 persons per square mile (rank—19th state)
Extent Area 158 693 square miles including 1 953 square miles of water surface (2d state in size)
Elevation: Highest (also highest in U S) Mount Whitney 14 495 feet lowest (also lowest dry land in U S) in Death Valley 282 feet below sea level
Temperature (°F) Average—annual 59° winter 4?° spring 57° summer 74° fall ?1 Lowest recorded −45 (Boca Nevada County Jan 20 1937) highest recorded 134° (Greenland Ranch Inyo County *July 10 1913*)
Precipitation Average (inches)—annual 21 winter 12 spring 5 summer less than 1 fall 4 Varies from about 100 in northwest to about 2 in southeast
Natural Features Mountains and valleys Great Central Valley cradled by Coast ranges and Sierra Nevada Tehachapi Mts connecting with Coast ranges in south separate northern and southern California San Bernardino Mts Death Valley Salton Sea and Imperial Valley in south Such natural harbors as San Francisco Bay Principal rivers Sacramento San Joaquin
Land Use Cropland 10% nonforested pasture 31% forest, 45%, other (roads parks game refuges, waste land cities etc) 14%



Natural Resources *Agricultural*—diverse climate varied surface and soil *Industrial*—petroleum and natural *gas hydroelectric power forests* and fisheries *Commercial*—natural ports tourist attractions

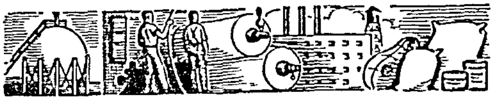
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Wholesale and retail trade	872 608	22 4
Manufacturing	763 680	19 5
Professional services (medical legal educational etc)	378 01[illegible]	9 7
Transportation communication and other public utilities	318 913	8 2
Construction	298 675	7 7
Agriculture forestry and fishery	298 119	7 6
Personal services (hotel domestic laundering, etc)	263 043	6 7
Government	246 230	6 3
Finance insurance and real estate	179 417	4 6
Business and repair services	130 260	3 3
Amusement recreation and related services	76 795	2 0
Mining	30 308	0 8
Workers not accounted for	46 218	1 2
Total employed	3 90[illegible] 278	100 0

California Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—6th)
Value added by manufacture* (1952), $6,960,932,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
FOOD AND KINDRED PRODUCTS . Canning, preserving, and freezing; beverages; bakery products	$851,836,000	3
TRANSPORTATION EQUIPMENT . . . . Aircraft; motor vehicles and parts; shipbuilding and repairing	553,718,000	2
FABRICATED METAL PRODUCTS. . . . Structural metal products; heating and plumbing equipment	291,323,000	6
MACHINERY (EXCEPT ELECTRICAL) . General industrial machinery; construction and mining machinery	284,785,000	11
CHEMICALS AND ALLIED PRODUCTS . Paints; vegetable and animal oils	280,195,000	7

*For explanation of value added by manufacture, see Census.

B. Farm Products (Rank among states—1st)
Total cash income (1952), $2,728,701,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Truck crops.....	3,188,000 tons	1	1
Milk	2,706,000,000 qts.	2	5
Cattle	663,279,000 lbs.	3	10
Grapes	2,608,000 tons	4	1
Oranges........	48,196,000 boxes	5	1
Hay...........	5,704,000 tons	6	4
Eggs	190,000,000 doz.	7	8
Cotton lint....	584,000 bales	8	7
Potatoes. . .	34,039,000 bu.	9	3

*Rank in dollar value †Rank in units produced

C. Fish (Rank among states—1st)
(Marine waters and coastal rivers, 1950), catch, 1,338,299,000 lbs.; value, $81,605,000

D. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $1,209,428,000
Rank among states—3d

Minerals (1951)	Amount Produced	Value
Petroleum.........	354,561,000 bbls.	$797,760,000
Natural gas........	566,751,000,000 cu. ft.	82,745,000
Natural-gas liquids.	29,533,000 bbls.	81,451,000
Cement...........	28,956,000 bbls.	77,754,000
Sand and gravel . .	46,928,000 tons	41,280,000

E. Lumber (Rank among states—3d)
2,635,000,000 board feet (5-year average)

F. Trade

Trade (1948)	Sales	Rank among States
Wholesale.........	$13,502,920,000	3
Retail............	11,019,804,000	2
Service..........	1,336,155,000	2

NATIONAL PARKS*

Kings Canyon—453,065 acres; two great canyons cut by Kings River; lakes; General Grant Tree (54).
Lassen Volcanic—103,809 acres; lava fields, hot springs, boiling lakes in area dominated by Lassen Peak (10,453 ft.), which last erupted 1914–21 (20).
Sequoia—385,178 acres; vast preserve of giant sequoias including General Sherman Tree, 272.4 ft. high; Mount Whitney, highest point in continental U.S., is within park; magnificent views from Moro Rock (60).
Yosemite—757,617 acres including glacier-carved Yosemite Valley; 3 great waterfalls; groves of sequoias (46).

STATE PARKS AND STATE MONUMENTS*†

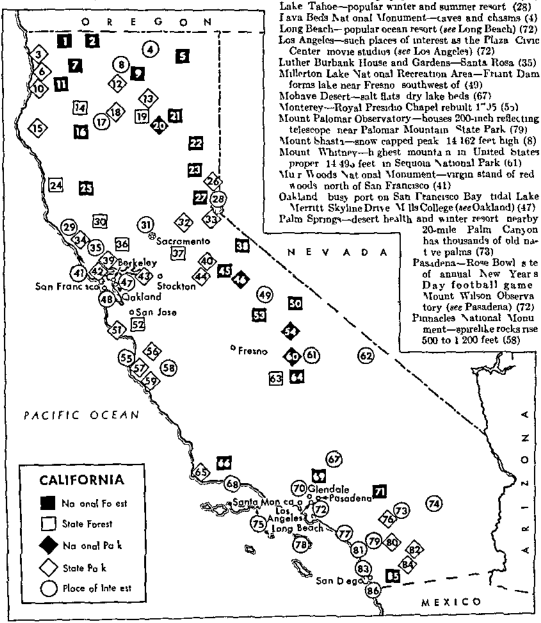
Anza Desert—in colorful desert of San Diego, Imperial cos.; Borrego Palm Canyon; many wild flowers (82).
Armstrong Redwoods—forest theater seats 3,000 (34).
Big Basin Redwoods—California's first state park, established 1902; redwoods up to 14-foot diameter (51).
Calaveras Big Trees—giant sequoias and pine forests; winter, summer sports; near Angels Camp (40).
Castle Crags—Sacramento River flows through park; mineral springs; trout fishing; near Dunsmuir (12).
Columbia Historic—well-preserved buildings of "ghost town" of Mother Lode, rich gold vein; near Sonora (44).
Cuyamaca Rancho—in San Diego County; beautiful forests and peaks of Cuyamaca Range (84).
D. L. Bliss—at Rubicon Point on Lake Tahoe; forested mountain area provides recreational facilities (33).
Del Norte Coast Redwoods—virgin forest and memorial groves; rhododendrons bloom in May and June (3).
Donner Memorial—honors Donner party caught in deep snows near Truckee in 1846; Pioneer Monument (26).
Frémont Peak—near San Juan Bautista; named for John C. Frémont; sweeping view from crest (56).
Gold Discovery Site—here James Marshall discovered gold at Sutter's sawmill, Jan. 24, 1848, bringing on rush of 1849; Marshall Monument Park includes his statue and restored cabin; both parks at Coloma (32).
Humboldt Redwoods—famous for "Founders' Tree," the world's tallest tree, 364 feet high (15).
La Purisima Mission—state's largest restored mission, includes 3 buildings; near Lompoc (65).
McArthur-Burney Falls Memorial—Burney Creek forms 125-foot falls; near Burney (13).
Mount Diablo—good view from crest; nr. Danville (43).
Mount San Jacinto—wilderness near Idyllwild (76).
Mount Tamalpais—hiking trails through forest; large mountain theater where annual play is presented (42).
Old Custom House—early 19th-century adobe structure; now houses museum of historic relics; Monterey (57).
Palomar Mountain—forested mountain park, next to site of world's largest reflector telescope (80).
Patrick's Point—a reserve of wild flowers; agate beach and spectacular rocky seacoast; near Trinidad (10).
Pfeiffer Big Sur—on Big Sur River; s. of Monterey (59).
Point Lobos Reserve—rugged seacoast area featuring rare Monterey cypress; seals; near Carmel (57).
Prairie Creek Redwoods—mixed forest near Orick (6).
Shasta—near Redding; gold rush "ghost town" includes courthouse, jail, general store (18).
Sonoma Mission—Mission San Francisco de Solano founded in 1823; most northerly of missions (39).
Vallejo Home—built 1851 by Gen. Mariano G. Vallejo, commandant of n. Calif.; at Sonoma (39).

*Numbers in parentheses are keyed to map.
†There are 127 state parks, historical monuments, arboretums, and museums; 28 are given.

California Fact Summary

PLACES OF INTEREST*

Cabrillo National Monument—Point Loma from here Juan Cabrillo first sighted what is now California (83)
Channel Islands National Monument—unusual plant and animal life sea lion rookery elephant fossils (75)
Coronado—popular beach resort near San Diego (86)
Death Valley National Monument—hot barren desert lowest point in U S (*see* Death Valley) (62)
Devils Postpile National Monument—rock columns (49)
Dolores Mission—founded in 1776 the oldest building in San Francisco (48)
Feather River Canyon—magnificent deep gorge of North Fork of river midway between (17) and (28)
Folsom Dam—in Central Valley Project east of (31)
Forest Lawn Memorial Park—cemetery at Glendale includes replicas of Michelangelo s statues (72)
Hollywood—section of Los Angeles known as movie capital Hollywood Bowl Griffith Observatory (72)
Joshua Tree National Monument—desert area preserves nearly extinct Joshua trees desert flowers (74)
La Jolla—popular resort on rocky seacoast Scripps Institution of Oceanography famous marine museum (83)
Lake Tahoe—popular winter and summer resort (28)
Lava Beds National Monument—caves and chasms (4)
Long Beach—popular ocean resort (*see* Long Beach) (72)
Los Angeles—such places of interest as the Plaza Civic Center movie studios (*see* Los Angeles) (72)
Luther Burbank House and Gardens—Santa Rosa (35)
Millerton Lake National Recreation Area—Friant Dam forms lake near Fresno southwest of (49)
Mohave Desert—salt flats dry lake beds (67)
Monterey—Royal Presidio Chapel rebuilt 1795 (55)
Mount Palomar Observatory—houses 200-inch reflecting telescope near Palomar Mountain State Park (79)
Mount Shasta—snow capped peak 14 162 feet high (8)
Mount Whitney—highest mountain in United States proper 14 495 feet in Sequoia National Park (61)
Muir Woods National Monument—virgin stand of red woods north of San Francisco (41)
Oakland busy port on San Francisco Bay tidal Lake Merritt Skyline Drive Mills College (*see* Oakland) (47)
Palm Springs—desert health and winter resort nearby 20-mile Palm Canyon has thousands of old native palms (73)
Pasadena—Rose Bowl site of annual New Year s Day football game Mount Wilson Observatory (*see* Pasadena) (72)
Pinnacles National Monument—spirelike rocks rise 500 to 1 200 feet (58)



*Numbers in parentheses are keyed to map

Russian River Area—redwoods, sandy beaches in w. Sonoma Co.; Armstrong Redwoods State Park in area (29).
Sacramento—Capitol Park and the Capitol; restored Sutter's Fort, site of 1st settlement (*see* Sacramento) (31).
San Carlos Mission—Carmel; founded in 1770, rebuilt in 1880's; original paintings and statuary preserved (55).
San Diego—such places of interest as Balboa Park and "Old Town" (*see* San Diego) (83).
San Fernando Mission—founded in 1797, restored convent has 19 semicircular arches along main side (70).
San Francisco—such places as Golden Gate Bridge, Fisherman's Wharf, Chinatown (*see* San Francisco) (48).
San Gabriel Mission—now a parish church near Los Angeles; highly decorative main altar (72).
San Juan Capistrano Mission—famous for swallows which return each March; founded in 1776, damaged in earthquakes of 1812, 1918; now restored (77).
San Luis Rey Mission—Oceanside; fine architecture, composite of Spanish-Moorish and Mexican styles (81).
Santa Barbara—well-preserved Spanish Mission with museum; white stucco County Courthouse (68).
Santa Catalina Island—luxurious island resort; trips in glass-bottom boat; tours over Starlight Drive (78).
Shasta Dam—second highest dam in world, 602 ft., forms 46 sq. mi. reservoir; in Central Valley Project (17).
Stanford University—Herbert Hoover House and Hoover Library, both on the campus (48).

NATIONAL FORESTS*

Angeles—691,052 acres; hdqrs., Los Angeles (69).
Cleveland—567,103 acres; hdqrs., San Diego (85).
Eldorado—885,847 acres in state; total, 886,247 acres in California and Nevada; hdqrs., Placerville (27).
Inyo—1,781,669 acres in state; total, 1,844,017 acres in California and Nevada; hdqrs., Bishop (50).
Klamath—1,472,805 acres in state; total 1,497,257 acres in California and Oregon; hdqrs., Yreka (7).
Lassen—1,381,737 acres; hdqrs., Susanville (21).
Los Padres—2,007,025 acres; hdqrs., Santa Barbara (66).
Mendocino—1,082,634 acres; hdqrs., Willows (25).
Modoc—1,958,589 acres; hdqrs., Alturas (5).
Plumas—1,414,039 acres; hdqrs., Quincy (22).
Rogue River—56,206 acres in state; total, 1,203,630 acres in Calif. and Ore.; hdqrs., Medford, Ore. (2).
San Bernardino—812,633 acres; hdqrs., San Bernardino (71).
Sequoia—1,182,589 acres; hdqrs., Porterville (64).
Shasta—2,133,907 acres; hdqrs., Mount Shasta (9).
Sierra—1,459,332 acres; hdqrs., North Fork (53).
Siskiyou—38,729 acres in state; total, 1,389,169 acres in Calif. and Ore.; hdqrs., Grants Pass, Ore. (1).
Six Rivers—1,086,785 acres; hdqrs., Eureka (11).
Stanislaus—1,100,709 acres; hdqrs., Sonora (45).
Tahoe—1,190,264 acres, hdqrs., Nevada City (23).
Toiyabe—695,783 acres in state; total, 3,567,563 in Calif. and Nev.; hdqrs., Reno, Nev. (38).
Trinity—1,202,675 acres; hdqrs., Weaverville (16).

STATE FORESTS*

Boggs Mountain (Lake County)—3,433 acres (30).
Ellen Pickett (Trinity County)—160 acres (14).
Jackson (Mendocino County)—52,041 acres (24).
Las Pasados (Napa County)—796 acres (36).
Latour (Shasta County)—9,013 acres (19).
Loghry (Santa Clara, Santa Cruz Cos.)—68 acres (52).
Mtn. Home Tract (Tulare County)—4,562 acres (63).
Mount Zion (Amador County)—164 acres (37).

* Numbers in parentheses are keyed to map.

EDUCATION

Public Schools: Elementary, 3,758; secondary, 793. Compulsory school age, 8 through 16. State Board of Education consists of 10 members appointed by the governor for 4-year terms. Supt. of public instruction elected for 4-year term, acts as executive officer of state board. The 5 members of most county boards of education appointed by county boards of supervisors. Most county supts. elected for 4-year terms. City or district boards either elected or appointed by county supt. or city council. City or district supts. elected by their boards.

Private and Parochial Schools: 516.

Colleges and Universities: Colleges, 38; junior colleges, 52. State-supported schools include the University of California at Berkeley with 7 campuses elsewhere in the state; California State Polytechnic College, San Luis Obispo; 9 state colleges—Chico, Fresno, Humboldt, Los Angeles, Sacramento, San Diego, San Francisco, San José, and Long Beach; California Maritime Academy, Vallejo.

State Schools for the Handicapped: California School for the Blind and California School for the Deaf, Berkeley; 2 Schools for Cerebral-Palsied Children, Redwood City and Altadena; State School for the Deaf, Riverside.

Libraries: City and town libraries, 157; county libraries, 51, of which 7 contract for service with city or other county libraries. State library responsible for assistance in developing library service. Work headed by state librarian. Noted special libraries: Henry E. Huntington Library and Art Gallery, San Marino; Sutro Library, San Francisco.

Outstanding Museums: California Palace of the Legion of Honor, M. H. de Young Memorial Museum, San Francisco Museum of Art, all in San Francisco; Santa Barbara Museum of Art; Santa Barbara Museum of Natural History; E. B. Crocker Art Gallery, Sacramento; H. E. Huntington Library and Art Gallery, San Marino; Los Angeles County Museum, Southwest Museum, Los Angeles; Mills College Art Gallery, Oakland; Fine Arts Gallery of San Diego.

CORRECTIONAL AND PENAL INSTITUTIONS

Under administration of California Youth Authority: Ben Lomond Forestry Camp, Santa Cruz; Coarsegold Forestry Camp, Coarsegold; Fricot Ranch School for Boys, San Andreas; Los Guilucos School for Girls; Santa Rosa; Fred C. Nelles School for Boys, Whittier; Paso Robles School for Boys, Paso Robles; Pine Grove Forestry Camp, Pine Grove; Preston School of Industry, Waterman; Ventura School for Girls, Ventura; Northern Reception Center & Clinic, Perkins; Southern Reception Center & Clinic, Norwalk. California State Prison, San Quentin and Soledad; California State Prison at Folsom, Represa; California Inst. for Men, Chino; California Inst. for Women, Corona; Deuel Vocational Inst., Tracy; California Medical Facility, Terminal Island, San Pedro.

LARGEST CITIES (1950 census)

Los Angeles (1,970,358): man-made harbor; shipbuilding, fishing, petroleum, moving-picture industries; makes tires, aircraft, women's clothing; tourist trade.

San Francisco (775,357): shipping; meat packing, food canning, oil refining, shipbuilding, steel, chemicals.

California Fact Summary

Oakland (384 575) on San Francisco Bay manufactures *food products* automobiles and parts chemicals
San Diego (334 387) land locked harbor U S Navy s main Pacific coast base largest industry—aircraft
Long Beach (250 767) Pacific port and resort one of nation s chief petroleum producers shipbuilding
Sacramento (137 572) state capital fruit and vegetable canning railroad shops McClellan Air Force Base
Berkeley (113 805) bay city main campus of U of California pharmaceutical products ink soap engines
Pasadena (104 577) residential resort city Rose Bowl
Richmond (99 545) port oil refining automobiles
Glendale (95 702) air terminal aircraft motion pictures
San Jose (95 280) fruit shipping and canning center
Fresno (91 669) fruit processing wine farm equipment
Burbank (78 577) air terminal aircraft motion pictures
Santa Monica (71 595) residential beach resort aircraft
Stockton (70 853) river port canning farm machinery

THE PEOPLE BUILD THEIR STATE

1542—Juan Rodríguez Cabrillo and his pilot Bartolomé Ferrelo enter what is now San Diego Bay They explore California coast in search of sea passage to Atlantic claim coastlands for Spain
1579—Sir Francis Drake in the *Golden Hind* visits bay 30 miles north of present San Francisco bay named for him claims surrounding area for England names it New Albion
1584—Francisco Gali explores California coast
1602—Sebastián Vizcaíno recharts coast names many places first mass celebrated in California
1697—Charles II of Spain grants Jesuits warrant to establish missions in California
1701—Father Eusebio Kino crosses Colorado River near Yuma and works with Indians of Upper California.
1767—Charles III orders Jesuits out of California and assigns missionary work there to Franciscans
1769—Father Junípero Serra head of Franciscan missionaries and Don Gaspar de Portolá establish first Spanish mission at San Diego de Alcalá July 16 first of 21 missions set up by 1823 Portolá and party sight San Francisco Bay on exploration trip
1770—First vineyards set out First orange trees planted with first orange grove at San Gabriel Mission 1804 and first commercial grove 1841
1775—Indians attack and burn San Diego Mission
1776—Juan Bautista de Anza brings first settlers across Sierra Nevada to establish San Francisco Presidio, March 28
1777—San José de Guadalupe California s first pueblo founded
1781—Indians destroy mission at Yuma (now in Arizona)
1796—First U S ship the *Otter* docks at Monterey, beginning heavy U S California trade despite Spanish law forbidding it
1812—Russians build Fort Rossiya (Ross) north of San Francisco in 1841 they sell it to John Sutter
1821—Mexico wins its independence from Spain
1822—Californians at Monterey declare their independence from Spain April 9 set up legislature November 9
1825—Mexico claims California as a territory
1831—Californians revolt against harsh Mexican governor Manuel Victoria forcing his removal
1833—Mexico begins to secularize missions
1836—Californians revolt forming free state but return to Mexican rule when concessions are granted.
1839—Capt John Sutter founds present Sacramento.
1841—John Bidwell and John Bartleson lead first organized *party of U S settlers into California* group travels overland five months from Missouri
1844—John C Frémont leads military expedition to California makes second visit in 1845 Mexico orders him to leave but he refuses
1846—American settlers rebel against Mexico *seize* Sonoma June 14 raising Bear Flag of short-lived California Republic Com John Sloat claims California for U S U S troops land at San Pedro July 15 entering Los Angeles August 13 First American school founded at Mission Santa Clara First settlers from around the Horn arrive in San Francisco July 31 Ill fated Donner party reaches Truckee in November but only 45 of 81 members survive winter encampment
1847—U S forces win battles of San Gabriel and La Mesa January 8-9 Mexican general Andreas Pico surrenders California to General Frémont and the U S
1848—By Treaty of Guadalupe-Hidalgo February 2 Mexico formally cedes California to U S James Marshall discovers gold at Sutter s millrace January 24 discovery launches gold rush of 1849
1849—State constitution written Californians proclaim themselves a state and petition for admission to Union leads to eight-month dispute particularly over antislavery clause in Constitution Regular steamboat service begins on Sacramento River
1850—California admitted to Union September 9 as free state First free schools founded in San Francisco
1851—Santa Clara College (now U of Santa Clara) at Santa Clara and California Wesleyan College (now College of the Pacific) at Stockton are founded
1852—Agoston Haraszthy begins vineyard development
1854—Sacramento chosen state capital February 25. U S Mint begins operations at San Francisco
1857—First of Bret Harte s many writings on California published in *Golden Era* in San Francisco
1858—Butterfield stagecoaches bring first overland mail to state use southern route through Tucson Ariz
1861—Transcontinental telegraph links California with East coast October 24
1862—Drought forces Mexican cattlemen to sell land land boom revolutionizes California agriculture
1863—Construction of Central Pacific Railroad begins unites with Union Pacific completing transcontinental line in Utah May 10 1869
1867—Mark Twain as California journalist begins his career as humorist when his story The Celebrated Jumping Frog of Calaveras County is published
1868—U of California created from private school at Oakland opens 1869 moves to Berkeley 1873
1871—Anti-Chinese feeling develops into riots
1872—Opening of irrigation projects leads to development of truck gardening and similar agriculture
1873—Modoc War marks end of conflicts with Indians Navel orange from Brazil introduced at Riverside
1874—First oil refinery in state built near Newhall
1875—Luther Burbank settles at Santa Rosa beginning his revolutionary botanical experiments there and later at farm at Sebastopol from 1893 Bank of California fails leads to financial panic
1876—Southern Pacific Railroad completes link between San Francisco and Los Angeles September 6

California Fact Summary

1879—State adopts present constitution increasing popular control of government.

1882—Treaty with China recognizes right of U. S., demanded by Californians, to "limit or suspend" immigration of Chinese.

1883—Southern Pacific Railway links California with Gulf of Mexico and the South.

1885—Real-estate boom reaches peak; collapses in 1887. Santa Fe Railroad completes line to California.

1890—State Highway Commission created. Yosemite National Park established.

1891—Herbert Hoover, later 31st president of U. S., enters first class at Leland Stanford Junior University at Palo Alto; after graduation, he works in engineering office in San Francisco.

1893—First fruit-marketing co-operatives launched.

1906—Earthquake and fire devastate San Francisco.

1907—Segregation of Japanese in public schools ends. "Gentlemen's agreement" between U. S. and Japan limits Japanese immigration.

1908—California's first commercial movie, 'The Count of Monte Cristo', filmed in Los Angeles. First film made in Hollywood, 1911.

1911—Los Angeles Harbor breakwater completed.

1913—The 233-mile-long Owens River Aqueduct for Southern California completed. Webb Act bans aliens from owning agricultural land; Alien Land Law supplements act in 1920.

1915—Expositions opened at San Francisco and San Diego to celebrate completion of Panama Canal in 1914.

1916—Preparedness Day bombing, July 22, at San Francisco, marks labor unrest. Thomas Mooney and Warren K. Billings convicted of crime, leading to long legal battle over case; Mooney pardoned, Billings' sentence commutated, 1939.

1920—New oil fields boost state's oil production.

1930—Census reveals California's population increased 65 per cent in decade, now sixth state in rank.

1931—San Francisco-Hetch Hetchy Valley Aqueduct completed.

1932—Los Angeles site of X Olympic Games.

1933—Extensive migration to California from Dust Bowl begins, increasing unemployment in state.

1935—San Diego begins celebration of the California-Pacific International Exposition.

1936—San Francisco-Oakland Bay Bridge completed. First commercial transpacific flight links San Francisco by air with Philippines.

1937—Golden Gate Bridge completed.

1939—San Francisco's Golden Gate International Exposition opens.

1941—Colorado Aqueduct serving Los Angeles and Southern California completed, largest in world.

1942—Japanese submarine shells coast near Ellwood. Japanese along coast evacuated and resettled. War industries bring new residents to state.

1944—Japanese allowed to return to coastal areas, but many choose not to do so.

1945—United Nations Charter drawn up at San Francisco.

1948—Work begins on Folsom Dam on American River. Centennial of gold rush celebrated at Coloma.

1950—Census shows California is 2d most populous state; population increased 53 per cent in decade.

1951—Central Valley Project for irrigation and power begins with release of water from Shasta Dam. Japanese Peace Conference held in San Francisco.

1952—State supreme court rules Alien Land Law of 1920 unconstitutional, also invalidates University of California's 1950 non-Communist loyalty oath required of teachers and employees. California's U. S. Senator Richard M. Nixon, born at Yorba Linda (1913), elected vice-president of U. S.

1953—Pres. Eisenhower signs bill giving California title to oil within 3 miles of its coast. Gov. Earl Warren, born at Los Angeles (1891), appointed chief justice of U. S. Supreme Court.

CULTURE AND SCIENCE IN CALIFORNIA

Hollywood Bowl is in a natural amphitheater in Beachwood Canyon, Hollywood. Here are heard every year the Easter Sunrise Service, "symphonies under the stars," and operas. The bowl seats 20,000 and has standing room on the runways for 10,000.

Rising from the forest are the white domes, towers, and buildings of the world-famous Mount Wilson Observatory. The two great domes house 100-inch and 60-inch telescopes. The two towers, 150 feet and 60 feet high, are for observing the sun.

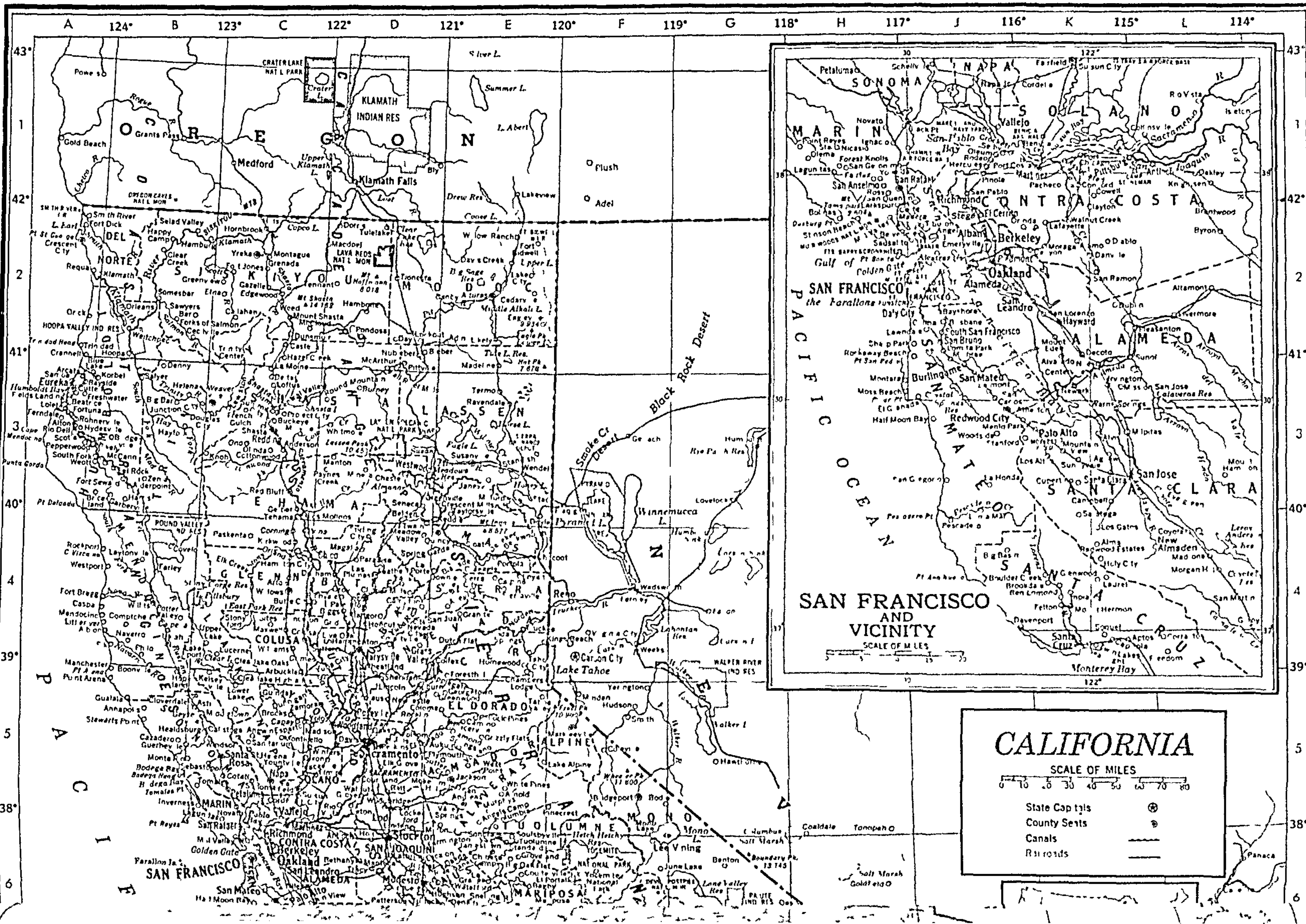
COUNTIES

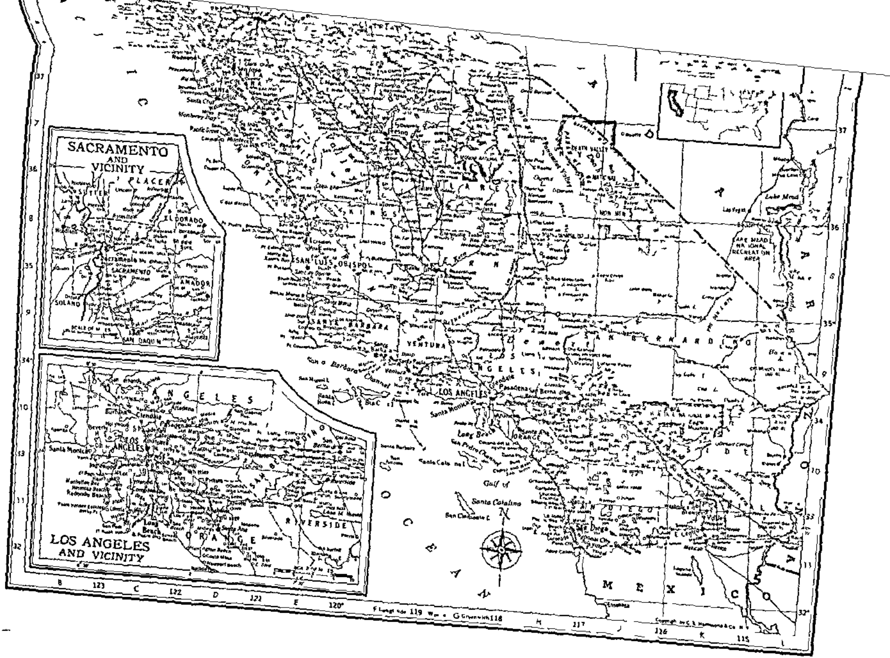
Alameda	740 315	D 6
Alpine	241	F 5
Amador	9 151	F 5
Butte	64 930	D 4
Calaveras	9 902	E 5
Colusa	11 651	C 4
Contra Costa	298 984	D 6
Del Norte	8 078	B 2
El Dorado	16 207	F 5
Fresno	276 515	F 7
Glenn	15 448	C 4
Humboldt	69 241	B 3
Imperial	62 975	K 10
Inyo	11 658	H 7
Kern	224 319	G 8
Kings	46 768	F 8
Lake	11 481	C 4
Lassen	18 474	E 3
Los Angeles	4 151 687	G 9
Madera	36 964	F 6
Marin	85 619	C 5
Mariposa	5 145	F 6
Mendocino	40 854	B 4
Merced	69 780	E 6
Modoc	9 678	F 2
Mono	2 115	F 5
Monterey	130 498	D 7
Napa	46 603	C 5
Nevada	19 888	E 4
Orange	216 224	H 10
Placer	41 649	F 4
Plumas	13 519	E 4
Riverside	170 046	J 10
Sacramento	277 140	D 5
San Benito	14 370	D 7
San Bernardino	281 642	J 9
San Diego	556 808	J 11
San Francisco	775 357	J 2
San Joaquin	200 750	D 6
San Luis Obispo	51 417	F 8
San Mateo	235 659	C 6
Santa Barbara	98 220	E 9
Santa Clara	290 547	D 6
Santa Cruz	66 534	C 6
Shasta	36 413	C 3
Sierra	2 410	E 4
Siskiyou	30 733	C 2
Solano	104 833	D 5
Sonoma	103 405	C 5
Stanislaus	127 231	D 6
Sutter	26 239	D 4
Tehama	19 276	C 3
Trinity	5 087	B 3
Tulare	149 264	G 7
Tuolumne	12 584	F 5
Ventura	114 647	F 9
Yolo	40 640	D 5
Yuba	24 420	D 4

CITIES AND TOWNS

Acampo	800	C 9
Adelanto	623	H 9
Adin		F 2
Agnew	700	K 3
Ahwahnee	400	F 6
Alameda	64 430	J 2
Alamo	263	K 2
Albany	17 590	J 2
Alberhill	300	E 11
Albion	350	B 4
Alderpoint	200	B 3
Alhambra	51 359	C 10
Alisal	16 714	D 7
Alleghany	300	E 4
Alma	600	K 4
Alpaugh	1 000	F 8
Alta Loma	1 500	E 10
Altadena	37 500	C 10
Altamont	65	L 2
Alton	275	A 3
Alturas	2 819	E 2
Alvarado	2 000	K 2
Alviso	652	K 3
Amador City	151	*E 5
Amboy	150	K 9
Anaheim	14 556	D 11
Anderson	1 501	C 3
Angels Camp	1 147	E 5
Angwin	2 000	C 5
Annapolis		B 5
Antelope	111	C 8
Antioch	11 051	L 1
Apple Valley	1 400	H 9
Applegate	300	E 5
Aptos	2 000	K 4
Arbuckle	1 150	C 4
Arcadia	23 066	D 10
Arcata	3 723	A 3
Arlight		E 9
Arlington	4 326	E 11
Armona	1 274	F 7
Arnold	375	E 5
Aromas	700	D 7
Arroyo Grande	1 723	E 8
Artesia	15 920	C 11
Artois	170	C 4
Arvin	5 007	G 8
Associated	2 0	K 1
Asti	300	C 5
Atascadero	3 443	E 8
Atherton	3 630	K 3
Atolia	25	H 8
Atwater	2 8 6	E 6
Atwood	500	D 11
Auberry	477	F 6
Auburn	4 653	C 8
Aukum		E 5
Avalon	1 506	G 10
Avenal	3 982	E 8
Azusa	11 042	D 10
Bagby	50	E 6
Baker	300	J 8
Bakersfield	34 784	G 8
Balboa	3 000	D 11
Baldwin Park	28 000	D 10
Bangor	335	D 4
Banning	7 034	J 10
Bard	45	L 11
Barstow	6 135	H 9
Bayshore	2 726	J 2
Bayside	650	B 3
Beatrice	100	A 3
Beaumont	3 152	J 10
Beckwourth	75	E 4
Belden	500	D 3
Bell	15 430	C 11
Bellflower	40 000	C 11
Belmont	5 567	J 3
Belvedere	800	H 2
Ben Lomond	1 500	K 4
Benicia	7 284	K 1
Benton	110	G 8
Berkeley	113 805	J 2
Bethany	25	D 6
Betteravia	850	E 9
Beverly Hills	20 032	B 10
Bieber	600	D 2
Big Bar	210	B 3
Big Basin	60	J 4
Big Bear City	476	J 9
Big Bear L	1 434	J 9
Big Creek	368	F 6
Big Oak Flat	150	F 6
Biggs	784	D 4
Bigpine	800	G 6
Biola	500	F 7
Bishop	2 891	G 6
Black Point	431	J 1
Blairsden	90	E 4
Bloomington	10 100	E 10
Blue Jay	306	H 9
Blue Lake	824	A 3
Blythe	4 089	L 10
Bodega Bay	350	B 5
Bodfish	247	G 8
Bodie	20	F 5
Bolinas	1 006	H 1
Boonville	1 500	B 5
Boron	236	H 8
Boulder Cr	1 437	J 4
Boulevard	75	J 11
Bowles	150	F 7
Bradley	100	F 8
Brawley	11 922	K 11
Brea	3 208	D 11
Brentwood	1 729	L 2
Briceland	175	B 3
Bridgeport	250	F 6
Bridgeville	475	B 3
Brisbane	4 500	J 2
Broderick	3 500	B 8
Brookdale	150	J 4
Brooks	75	C 5
Bryn Mawr	300	F 10
Bryte	3 000	B 8
Buckeye	275	C 3
Buellton	450	E 9
Buena Park	5 483	D 11
Burbank	78 577	C 10
Burlingame	19 886	J 3
Burney	1 513	D 3
Burrel	100	E 7
Butte City	150	C 4
Buttonwillow	1 000	F 8
Byron	1 117	L 2
Cadiz	50	K 9
Calexico	6 433	K 11
Calipatria	1 428	K 10
Calistoga	1 418	C 5
Callahan	250	C 2
Calpella	350	B 4
Calpine	75	F 4
Camanche	75	C 9
Camarillo	2 500	F 9
Cambria	1 300	D 8
Camino		E 5
Campbell	10 000	K 3
Campo	550	J 11
Campo Seco	100	D 9
Camptonville	350	D 4
Canby	505	E 2
Cantil	150	H 8
Canyon	400	K 2
Capay	112	C 5
Capistrano Beach	700	H 10
Capitola	1 848	K 4
Carlsbad	4 383	H 10
Carmel	4 351	C 7
Carpinteria	2 864	F 9
Cartago	94	G 7
Caruthers	800	E 7
Casa Blanca	1 585	E 11
Casmalia	180	E 9
Caspar	400	B 4
Castaic		G 9
Castella	350	C 2
Castroville	1 865	D 7
Cathay	200	E 6
Cathedral City	2 038	J 10
Cayucos	1 500	E 8
Cazadero	350	B 5
Cecilville	50	B 2
Cedarville	850	E 2
Centerville	1 401	K 3
Central Valley	2 202	C 3
Ceres	2 151	D 6
Chambers Lodge	25	F 4
Chester	1 197	D 3
Chico	12 272	D 4
Chilcoot	75	E 4
Chinese Camp	150	E 6
Chino	5 744	D 10
Cholame	500	E 8
Chowchilla	3 813	E 6
Chrisman	4 211	F 9
Chualar	450	D 7
Chubbuck	46	K 9
Chula Vista	15 927	J 11
Cima	40	K 8
Claremont	6 327	D 10
Clarksburg		B 9
Clay	52	C 9
Clayton	680	K 2
Clear Creek	6	B 2
Clearlake Highlands	850	C 5
Clearlake Oaks	750	C 4
Clearwater	8 586	C 11
Clements	242	C 9
Clipper Mills	100	D 4
Cloverdale	1 292	B 6
Clovis	2 766	F 7
Coachella	2 755	J 10
Coalinga	5 539	E 7
Coarsegold	300	F 6
Coleville	250	F 5
Colfax	820	E 4
Collinsville	30	L 1
Colma	2 500	J 2
Colma (Lawndale)	217	H 2
Coloma	350	D 5
Colton	14 465	E 10
Columbia	650	F 5
Colusa	3 031	C 4
Comptche	150	B 4
Compton	47 991	C 11
Concord	6 953	K 1
Corcoran	3 150	F 7
Cordelia	365	K 1
Corning	2 537	C 4
Corona	10 223	E 11
Corona del Mar	4,500	G 10
Coronado	12 700	H 11
Corralitos	300	L 4
Corte Madera	1 933	J 2
Coso Junction	40	H 7
Costa Mesa	11 844	D 11
Cotati	683	C 5
Cottonwood	900	C 3
Coulterville	350	E 6
Courtland	750	B 9
Covelo	550	B 4
Covina	3 956	D 10
Cowell	200	K 1
Coyote	150	L 4
Crannell	428	A 2
Crescent City	1 706	A 2
Crescent Mills	300	F 3
Crestline	1 000	H 9
Creston	85	F 8
Crockett	6 000	J 1
Cross Roads	42	L 9
Crows Landing	500	D 6
Crucero		J 8
Cucamonga	1 255	E 10
Culver City	19 720	B 10
Cupertino	2 448	K 3
Cutler	1 768	F 7
Cutten	1 340	A 3
Cuyama	1 079	F 9
Cypress	1 318	D 11
Daggett	835	H 9
Daly City	15 191	H 2
Dana Point	500	H 10
Danville	3 130	K 2
Darwin	450	H 7
Davenport	300	K 4
Davis	3 554	B 8
Davis Creek	120	E 2
Day	65	D 2
Death Valley	100	J 7
Declezville		E 10
Decoto	2 830	K 2
Deep Springs	50	H 6
Del Mar	1 800	H 11
Del Paso Hts.	15 000	B 8
Del Key	750	F 7
Del Rosa	1 154	E 10
Delano	8 717	F 8
Delhi	1 000	E 6
Delleker	250	E 4
Delpiedra	56	F 7
Delta	100	C 3
Denair	860	E 6
Denny	55	B 2
Descanso	400	J 11
Desert Center	160	K 10
Diablo	879	K 2
Diamond Sprs.	1 200	D 8
Dinkey Creek	90	F 6
Dinuba	4 971	F 7
Dixon	1 714	B 9
Dorris	892	D 2
Dos Palos	1 394	E 6
Douglas City	95	C 3
Downey	35 000	C 11
Downieville	450	F 4
Doyle	77	F 3
Drytown	155	C 8
Duarte	10 000	D 10
Dublin	200	K 2
Ducor	155	G 8
Dunnigan	175	C 5
Dunsmuir	2 428	C 2
Durham	1 600	D 4
Dutch Flat	220	E 4
Eagle Mountain		K 10
Eagleville		E 2
Earlimart	2 162	F 8
Earp	7	L 9
E. Bakersfield	38 177	G 8
Edgewood	200	C 2
Edwards	192	G 9
Eel Rock	100	B 3
El Cajon	5 600	J 11
El Centro	12 590	K 11
El Cerrito	18 011	J 2
El Dorado	600	C 8
El Granada	300	H 3
El Modeno	1 500	D 11
El Monte	8 101	D 10
El Nido	765	E 6
El Portal	279	F 6
El Segundo	8 011	B 11
El Toro	200	F 11
Elk	150	B 4
Elk Creek	210	C 4
Elk Grove	1 200	B 9
Elmira	200	D 5
Elsinore	2 068	F 11
Elverta	850	B 8
Emeryville	2 889	J 2
Empire	1 448	D 6
Encanto	7 300	J 11
Encinitas	7 000	H 10
Escalon	1 569	E 6
Escondido	6 544	H 10
Esparto	300	C 5
Essex	60	K 9
Etiwanda	1 200	E 10
Etna	649	C 2
Eureka	23 058	A 3
Evergreen	300	L 3
Exeter	4 078	F 7
Fair Oaks	5 000	C 8
Fairfax	4 078	H 1
Fairfield	3 118	K 1
Fairmead	250	E 6
Fall River Mills	600	D 3
Fallbrook	1 735	H 10
Famoso	100	F 8
Farley		B 4
Farmersville	5 000	F 7
Farmington	173	E 6
Fawnskin	350	J 9
Feather Falls	1 500	D 4
Fellows	343	F 8
Felton	1 200	K 4
Fenner	25	K 9
Ferndale	1 012	A 3
Fields Landing	270	A 3
Fillmore	3 884	F 9
Firebaugh	821	F 7
Fish Camp	25	F 6
Florin	500	B 8
Folsom	1 690	C 8
Fontana	25 000	E 10
Ford City	4 347	F 8
Forest Knolls	500	H 1
Foresthill	1 000	E 4
Forks of Salmon	185	B 2
Fort Bidwell	275	F 2
Fort Bragg	3 826	B 4
Fort Dick	600	A 2
Fort Jones	525	C 2
Fort Seward	115	B 3
Fortuna	1 762	A 3
Fowler	1 857	F 7
Franklin	45	B 9
Freedom	2 765	L 4
Freeport	300	B 8
French Gulch	350	C 3
Freshwater	186	B 3
Fresno	91 669	F 7
Friant	950	F 7
Fullerton	13 958	D 11
Galt	1 333	C 9
Garberville	1 350	B 3
Garden Grove	3 762	D 11
Gardena	14 405	C 11
Gaviota	125	E 9
Gazelle	300	C 2
Georgetown	600	E 5
Gerber	700	C 3
Geyserville	925	B 5
Gilroy	4 951	L 4
Glamis	50	K 11
Glen Ellen	1 100	*C 5
Glendale	95 702	C 10
Glendora	3 988	D 10
Glennville	120	G 8
Glenwood	103	K 4
Goleta	1 549	F 9
Gonzales	1 821	D 7
Gorman		G 9
Goshen	525	F 7
Graeagle	300	F 4
Graniteville	25	F 4
Grapevine	100	F 9
Grass Valley	5 283	D 4
Greenfield	1 309	D 7
Greenview	200	B 2
Greenville	1 153	F 3
Greenwood	375	E 5
Grenada	250	C 2
Gridley	3 054	D 4
Grimes	500	C 4
Grizzly Flats	40	F 5
Groveland	365	F 6
Grover City	2 500	E 8
Guadalupe	2 429	E 9
Gualala	140	B 5
Guasti	400	E 10
Guerneville	1 250	B 5
Guinda	150	C 5
Gustine	1 084	D 6
Half Moon Bay	1 168	H 3
Hambone	8	D 2
Hamburg	150	B 2
Hamilton City	900	C 4
Hammonton	250	D 4
Hanford	10 028	F 7
Happy Camp	530	B 2
Harbor City	7 500	C 11
Harris	115	B 3
Hawthorne	16 316	B 11
Hayfork	1 200	B 3
Hayward	14 272	K 2
Hazel Creek	85	C 2
Healdsburg	3 258	B 5
Heber	300	K 11
Helena	40	B 3
Hemet	3 386	J 10
Herald		C 9
Hercules	343	J 1
Hermosa B	11 826	B 11
Hesperia	250	H 9
Highgrove	553	E 10
Highland	8 500	H 9
Hillsborough	3 552	*J 2
Hilmar	525	E 6
Hilts		C 2
Hinkley	75	H 9
Hollister	4 903	D 7
Hollywood	179 749	C 10
Holt	150	D 6
Holtville	2 472	K 11
Holy City	50	K 4
Homewood	8	E 4
Honcut	271	D 4
Hood	250	B 9
Hoopa	850	B 2
Hopland	1 150	B 5
Hornbrook	250	C 2
Hornitos	126	F 6
Hughson	1 816	E 6
Huntington Beach	5 237	D 11
Huntington Park	29 450	C 10
Huron	1 500	F 7
Hydesville	2 0	B 3
Idyllwild	604	J 10
Ignacio	180	H 1
Imperial	1 759	K 11
Independence	850	H 7
Indio	5 300	J 10
Inglewood	46 185	B 11
Inverness	550	B 5
Inyokern	266	H 8
Ione	1 071	C 9
Irvine	150	D 11
Irvington	2 500	K 3
Isabella	308	G 8
Isleton	1 597	L 1
Ivanhoe	1 172	F 7
Ivanpah	20	K 8
Jackson	1 879	C 9
Jacumba	600	J 11
Jamestown	1 300	F 6
Janesville	165	E 3
Jenny Lind		C 9
Johannesburg	200	H 8
Johnsondale	230	G 8
Julian	300	J 10
Junction City	95	B 3
June Lake	250	G 6
Keddie	600	E 3
Keeler	302	H 7
Keene	300	G 8
Kelseyville	550	C 5
Kelso	117	K 8
Kerman	1 563	E 7
Kernville	475	G 8
Kettleman City	450	E 7
King City	2 347	D 7
Kings Beach	500	F 4
Kingsburg	2 310	F 7
Kirkwood	56	C 4
Klamath	1 012	B 2
Knights Ldg	700	B 8
Knighteen	684	L 1
Knob	8	C 3
Korbel	350	B 3
La Canada	8 200	C 10
La Crescenta	16 000	C 10
La Grange	250	E 6
La Habra	4 961	D 11
La Honda	450	J 3
La Jolla	13 000	H 11
La Mesa	10 946	H 11
La Moine	125	C 3
La Porte	31	D 4
La Sierra	3 802	E 11

*No room on map for name.


CALIFORNIA
SCALE OF MILES
State Capitals
County Seats
Canals
Railroads
SAN FRANCISCO AND VICINITY
SCALE OF MILES
PACIFIC OCEAN
OREGON
Black Rock Desert
Lake Tahoe
Sacramento
San Francisco
Oakland
San Jose
Klamath Falls
Medford
Eureka


SACRAMENTO AND VICINITY
PLACER
SUTTER
EL DORADO
SACRAMENTO
AMADOR
SOLANO
SAN JOAQUIN
LOS ANGELES AND VICINITY
LOS ANGELES
ORANGE
RIVERSIDE
Santa Monica
Long Beach
Redondo Beach
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
KINGS
TULARE
KERN
SAN BERNARDINO
DEATH VALLEY
Santa Cruz
Fresno
Pasadena
Glendale
Santa Barbara Channel
Gulf of Santa Catalina
San Clemente I.
Santa Catalina I.
San Miguel I.
Santa Rosa I.
San Diego
Lake Mead
LAKE MEAD NATIONAL RECREATION AREA
Las Vegas
OCEAN
MEXICO
Ensenada
Longitude 119 West of Greenwich 118
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La Verne	4,198	D 10
Lafayette	10,500	K 2
Laguna Beach	6,661	G 10
Lagunitas	750	H 1
Lake Alpine	3	F 5
Lake Arrowhead	667	H 9
Lake City	94	E 2
Lake Hughes	224	G 9
Lakeport	1,983	C 4
Lakeside	1,500	J 11
Lakewood	31,000	C 11
Lamont	3,571	G 8
Lancaster	3,591	G 9
Larkspur	2,905	H 1
Las Plumas	55	D 4
Lathrop	600	D 6
Laton	881	F 7
Laurel	64	K 4
Lawndale	31,000	C 11
Lawndale (Colma)	297	H 2
Laws	75	G 6
Laytonville		B 4
Le Grand	1,000	E 6
Lebec	370	G 9
Lee Vining	450	F 6
Lemoncove	1,100	G 7
Lemoore	2,153	F 7
Lennox	25,000	C 11
Lenwood	250	H 9
Leucadia	500	H 10
Lewiston	300	C 3
Likely	200	E 2
Lincoln	2,410	B 8
Linden	426	D 5
Lindsay	5,060	G 7
Little Lake	50	H 8
Littleriver	300	B 4
Live Oak	1,770	D 4
Livermore	4,364	L 2
Livingston	1,502	E 6
Llano	30	H 9
Locke	295	B 9
Lockeford	1,000	C 9
Lodi	13,798	C 9
Loftus	200	C 3
Loleta	500	A 3
Loma Linda	4,000	E 10
Loma Mar	125	J 3
Lomita	10,000	C 11
Lomita Park	1,800	J 2
Lompoc	5,520	E 9
Lone Pine	1,415	H 7
Long Beach	250,767	C 11
Lonoak	15	E 7
Lookout	225	D 2
Loomis	350	C 8
Los Alamitos	1,800	D 11
Los Alamos	800	E 9
Los Altos	11,000	K 3
Los Angeles	1,970,358	C 10
Los Banos	3,868	E 6
Los Gatos	4,907	K 4
Los Molinos	600	D 3
Los Olivos	500	E 9
Lost Hills	300	F 8
Lotus	150	C 8
Lower Lake	275	C 5
Loyalton	911	E 4
Lucerne	350	C 4
Lucerne Valley	933	J 9
Ludlow	250	J 9
Lynwood	25,823	C 11
Macdoel	200	D 2
Madeline	60	E 2
Madera	10,497	E 7
Madison		D 5
Madrone	720	L 4
Magalia	200	D 4
Manchester	500	B 5
Manhattan Beach	17,330	B 11
Manteca	3,804	D 6
Manton	100	D 3
Maricopa	800	F 8
Mariposa	700	F 6
Markleeville	100	F 5
Martell	200	C 9
Martinez	8,268	K 1
Marysville	7,826	D 4
Maxwell	750	C 4
Maywood	13,292	C 10
McArthur	398	D 2
McCann	35	B 3
McCloud	1,394	C 2
McFarland	2,183	F 8
McKittrick	124	F 8
Meadow Valley	300	D 4
Mecca	837	K 10
Mendocino	1,250	B 4
Mendota	1,516	E 7
Menlo Park	13,587	J 3
Mentone	3,525	H 9
Merced	15,278	E 6
Michigan Bar	132	C 8
Middletown	400	C 5
Midland	700	L 10
Midway City	1,421	D 11
Milford	55	E 3
Mill Valley	7,331	H 2
Millbrae	8,972	J 2
Mills	300	C 8
Millville	246	C 3
Milpitas		L 3
Milton		E 5
Mineral	125	D 3
Mira Loma	1,555	E 10
Mission San Jose	1,080	L 3
Modesto	17,389	D 6
Mojave	2,055	G 8
Mokelumne Hill	495	E 5
Mono Lake	20	F 5
Monolith	450	G 8
Monrovia	20,186	D 10
Montague	579	C 2
Montalvo	1,200	F 9
Montara	400	H 3
Monte Rio	750	B 5
Montebello	21,735	C 10
Montecito	4,052	F 9
Monterey	16,205	D 7
Monterey Pk.	20,395	C 10
Monticello		C 5
Montrose	8,500	C 10
Moorpark	1,146	G 9
Moraga	325	K 2
Moreno	200	H 10
Morgan Hill	1,627	L 4
Morro Bay	1,659	D 8
Moss Beach	525	H 3
Moss Landing	300	C 7
Mount Eden	1,500	K 2
Mt. Hamilton		L 3
Mt. Hermon	150	K 4
Mount Owen		H 8
Mt. Shasta	1,909	C 2
Mountain Ctr.	40	J 10
Mountain View	6,563	K 3
Murphys	650	E 5
Murray	150	E 7
Napa	13,579	C 5
Napa Jct.	224	J 1
Nat'l City	21,199	J 11
Natoma	65	C 8
Navarro	117	B 4
Needles	4,051	L 9
Nevada City	2,505	D 4
New Almaden	300	L 4
Newark	1,532	K 3
Newberry	520	J 9
Newcastle	800	C 8
Newhall	2,327	G 9
Newman	1,815	D 6
Newport Beach	12,120	D 11
Nicasio	133	H 1
Nicolaus	100	B 8
Niland	700	K 10
Niles	1,519	K 3
Nipinnawasee		F 6
Nipomo	1,000	E 8
Nipton	15	K 8
Norco	1,584	E 11
Norden	220	E 4
North Fork	1,453	F 6
N. Sacramento	6,029	B 8
N. San Juan	250	E 4
Norwalk	6,300	C 11
Novato	3,496	H 1
Nubieber	400	D 2
Oakdale	4,064	E 6
Oakhurst	325	F 6
Oakland	384,575	J 2
Oakley	2,892	L 1
Oasis	25	G 6
Ocean Beach	16,600	H 11
Oceano	1,446	E 8
Oceanside	12,881	H 10
Oildale	16,615	F 8
Ojai	2,519	F 9
Olancha	200	H 7
Olema		H 1
Oleum	1,200	J 1
Olinda	411	C 3
Olinda	150	D 11
Olive	700	D 11
Olympia	150	K 4
O'Neals		F 6
Ono	38	C 3
Ontario	22,872	D 10
Onyx	150	G 8
Orange	10,027	D 11
Orange Cove	2,395	F 7
Orcutt	1,001	E 9
Orick	600	A 2
Orinda	5,000	K 2
Orland	2,067	C 4
Orleans	263	B 2
Oro Grande	556	H 9
Orosi	712	F 7
Oroville	5,387	D 4
Oxford	28	B 9
Oxnard	21,567	F 9
Pacheco	400	K 1
Pacific Beach	23,600	H 11
Pacific Grove	9,623	C 7
Paicines	300	D 7
Palermo	1,200	D 4
Palm City	3,000	H 11
Palm Springs	7,660	J 10
Palmdale	3,300	G 9
Palo Alto	25,475	K 3
Palo Verde	200	L 10
Palos Verdes Estates	1,963	B 11
Paradise	4,426	D 4
Paramount	10,006	C 11
Parker Dam	550	L 9
Parlier	1,419	F 7
Pasadena	104,577	C 10
Paskenta	350	C 4
Paso Robles	4,835	E 8
Patterson	1,343	D 6
Paynes Creek	35	D 3
Penryn	500	C 8
Pepperwood	300	A 3
Perkins	600	B 8
Perris	1,807	F 11
Pescadero	1,000	J 4
Petaluma	10,315	H 1
Philo	700	B 4
Pico	9,000	C 10
Piedmont	10,132	J 2
Pine Valley	300	J 11
Pinecrest	30	F 5
Pinedale	2,220	F 7
Pineridge	115	F 6
Pinole	1,147	J 1
Piru	1,500	G 9
Pismo Beach	1,425	E 8
Pittsburg	12,763	K 1
Pittville	50	D 2
Pixley	2,000	F 8
Placentia	1,682	D 11
Placerville	3,749	C 8
Planada	1,200	E 6
Plaster City	205	K 11
Pleasant Grove	30	B 8
Pleasanton	2,244	L 2
Plymouth	382	C 8
Point Arena	372	B 5
Pt. Reyes Sta.	500	H 1
Pollock Pines	850	E 5
Pomona	35,405	D 10
Pondosa	400	D 2
Port Chicago	3,000	K 1
Port Costa	587	J 1
Port Hueneme	3,024	F 9
Porterville	6,904	F 7
Portola	2,261	E 4
Potrero	200	J 11
Potter Valley	1,200	B 4
Pozo	200	E 8
Princeton	300	C 4
Project City	900	C 3
Puente	3,000	D 10
Quincy	1,330	E 4
Raisin	250	E 7
Ramona	1,158	J 10
Rancho Santa Fe	750	H 10
Randsburg	300	H 8
Ravendale	38	E 3
Raymond	200	F 6
Red Bluff	4,905	C 3
Red Mountain	250	H 8
Redding	10,256	C 3
Redlands	18,429	H 9
Redondo Beach	25,226	B 11
Redwood City	25,544	J 3
Redwood Estates	600	K 4
Reedley	4,135	F 7
Represa	3,000	C 8
Requa		A 2
Rialto	3,156	E 10
Rice	109	L 9
Richmond	99,545	J 1
Richvale	430	D 4
Ridgecrest	2,028	H 8
Rio Dell	1,862	A 3
Rio Linda	5,000	B 8
Rio Vista	1,831	L 1
Ripley	300	L 10
Ripon	1,550	D 6
Riverbank	2,662	E 6
Riverdale	713	E 7
Riverside	46,764	E 10
Robbins	150	B 8
Rockaway Beach	300	H 2
Rocklin	1,155	B 8
Rockport	750	B 4
Rodeo	6,500	J 1
Rohnerville	1,500	B 3
Rosamond	700	G 9
Rosemead	15,230	D 10
Roseville	8,723	B 8
Ross	2,179	H 1
Round Mountain	450	D 3
Ryde	397	B 9
SACRAMENTO	137,572	B 8
Sage	52	J 10
Saint Helena	2,297	C 5
Salinas	13,917	D 7
Salyer	250	B 3
Samoa	600	A 3
San Andreas	1,263	E 5
San Anselmo	9,188	H 1
San Ardo	500	E 7
San Benito	110	D 7
San Bernardino	63,058	E 10
San Bruno	12,478	J 2
San Carlos	14,371	J 3
San Clemente	2,008	H 10
San Diego	334,387	J 11
San Dimas	1,840	D 10
San Fernando	12,992	C 10
San Francisco	775,357	H 2
San Gabriel	20,343	C 10
San Geronimo	300	H 1
San Gregorio	250	J 3
San Jacinto	1,778	H 10
San Joaquin	632	E 7
San Jose	95,280	L 3
San Juan Bautista	1,031	D 7
San Juan Capistrano	1,250	H 10
San Leandro	27,542	J 2
San Lorenzo	10,570	K 2
San Lucas	400	E 7
San Luis Obispo	14,180	E 8
San Marino	11,230	D 10
San Martin	2,200	L 4
San Mateo	41,782	J 3
San Miguel	800	E 8
San Pablo	14,476	J 1
San Pedro	74,000	C 11
San Quentin		H 1
San Rafael	13,848	J 1
San Ramon	250	K 2
San Simeon	75	D 8
San Ysidro	2,381	J 11
Sanger	6,400	F 7
Sanitarium	750	C 5
Santa Ana	45,533	D 11
Santa Barbara	44,913	F 9
Santa Clara	11,702	K 3
Santa Cruz	21,970	K 4
Santa Margarita	500	E 8
Santa Maria	10,440	E 9
Santa Monica	71,595	B 10
Santa Paula	11,049	F 9
Santa Rosa	17,902	C 5
Santa Susana	1,000	B 10
Saratoga	1,329	K 4
Saticoy	2,216	F 9
Sausalito	4,828	H 2
Sawyers Bar		B 2
Schellville		J 1
Scotia	1,017	A 3
Seabright		K 4
Seal Beach	3,553	C 11
Seaside	10,226	D 7
Sebastopol	2,601	C 5
Seeley	500	K 11
Seiad Valley	41	B 2
Selby	403	J 1
Selma	5,964	F 7
Seneca		D 3
Sepulveda	4,500	B 10
Shafter	2,207	F 8
Shandon	510	E 8
Sharp Park	3,800	H 2
Shasta	900	C 3
Shell Beach	1,000	E 8
Sheridan	600	D 5
Shingle Springs	300	C 8
Shively	196	B 3
Shoshone	150	J 8
Sierra City	150	E 4
Sierra Madre	7,273	D 10
Sierraville	400	E 4
Signal Hill	4,040	C 11
Silverado	1,400	E 11
Simi	550	G 9
Sites	200	C 4
Sloat		E 4
Sloughhouse		C 8
Smartville	350	D 4
Smith River	700	A 2
Snelling	350	E 6
Soda Springs	400	E 4
Solana Beach	1,350	H 11
Soledad	2,441	D 7
Solvang	1,025	E 9
Somesbar	200	B 2
Sonoma	2,015	C 5
Sonora	2,448	E 6
Soquel	2,400	K 4
Soulsbyville	150	E 6
S. Bakersfield	12,120	F 8
S. Dos Palos	503	E 7
S. Fork	150	A 3
S. Gate	51,116	C 11
S. Pasadena	16,935	C 10
S. San Francisco	19,351	J 2
Spadra	1,200	D 10
Spreckels		D 7
Spring Garden	180	D 4
Springville	735	G 7
Stacy	23	E 3
Standard	300	E 6
Standish	45	E 3
Stanford	10,000	J 3
Stanton	1,762	D 11
Stauffer	100	F 9
Stege		J 2
Stewarts Point	200	B 5
Stinson Beach	400	H 2
Stirling City	750	D 4
Stockton	70,853	D 6
Stonyford	125	C 4
Stratford	400	F 7
Strathmore	2,500	F 7
Suisun City	946	K 1
Summerland	507	F 9
Summit City	1,000	C 3
Sunland	5,000	C 10
Sunnymead	885	F 11
Sunnyvale	9,829	K 3
Sunol	700	L 2
Sunset Beach	1,500	C 11
Surf	50	E 9
Susanville	5,338	E 3
Sutter	1,200	D 4
Sutter Creek	1,151	C 9
Taft	3,707	F 8
Tahoe City	250	E 4
Tahoe Valley		E 5
Tarzana	10,000	B 10
Taylorsville	250	E 3
Tecopa	150	J 8
Tehachapi	1,685	G 8
Tehama	314	C 3
Temecula	500	H 10
Temple City	25,000	C 10
Templeton	586	E 8
Tennant	450	C 2
Termo	58	E 3
Terra Bella	850	G 8
Thermal	942	J 10
Thornton	1,800	B 9
Tiburon	1,100	J 2
Tionesta		D 2
Tipton	1,000	F 7
Tomales		C 5
Topanga	3,728	B 10
Torrance	22,241	C 11
Tracy	8,410	D 6
Tranquillity	500	E 7
Tres Pinos	180	D 7
Trigo		F 7
Trinidad	188	A 2
Trinity Center	100	C 2
Trona	2,450	H 8
Truckee	1,025	E 4
Tujunga	14,000	C 10
Tulare	12,445	F 7
Tulelake	1,028	D 2
Tuolumne	1,284	E 6
Tupman	187	F 8
Turlock	6,235	D 6
Tustin	1,143	D 11
Twain	285	D 4
Twentynine Palms	1,022	K 9
Twin Lakes		K 4
Twin Peaks	489	H 9
Ukiah	6,120	B 4
Upland	9,203	D 10
Upper Lake	600	C 4
Vacaville	3,169	D 5
Vallejo	26,038	J 1
Valley Center	50	J 10
Valley Springs	500	C 9
Van Nuys	90,000	B 10
Venice	58,871	B 11
Ventucopa	40	F 9
Ventura	16,534	F 9
Verdugo City	2,100	C 10
Vernon	432	C 10
Victor		C 9
Victorville	3,241	H 9
Vidal	50	L 9
Vina	500	D 4
Visalia	11,749	F 7
Vista	1,705	H 10
Volcano	150	E 5
Vorden	175	B 9
Wallace	55	C 9
Walnut Creek	2,420	K 2
Walnut Grove	1,250	B 9
Warm Springs	600	K 3
Wasco	5,592	F 8
Waterford	1,777	E 6
Watsonville	11,572	D 7
Weaverville	1,800	C 3
Weed	2,739	C 2
Weitchpec	300	B 2
Weldon	196	G 8
Wendel	39	E 3
Weott	450	A 3
W. Covina	4,499	D 10
W. Point	1,500	E 5
W. Riverside	3,798	E 10
W. Sacramento	8,200	B 8
Westend	400	H 8
Westminster	3,131	D 11
Westmorland	1,213	K 10
Westport	157	B 4
Westwood	3,618	D 3
Wheatland	581	D 4
Wheeler Ridge	250	G 8
White Pines	425	E 5
Whitmore	30	D 3
Whittier	23,820	D 11
Wildomar	350	H 10
Williams	1,134	C 4
Willits	2,691	B 4
Willow Ranch	275	E 2
Willows	3,019	C 4
Wilmar	8,000	C 10
Wilmington	30,000	C 11
Wilton	263	C 9
Windsor	600	C 5
Winterhaven	400	L 11
Winters	1,265	D 5
Winton	496	E 6
Woodbridge	850	B 9
Woodlake	2,525	G 7
Woodland	9,386	B 8
Woodside	2,000	J 3
Woody	150	G 8
Yermo	775	J 9
Yettem	150	F 7
Yolanda		H 1
Yolo	700	B 8
Yorba Linda	2,000	D 11
Yosemite Nat'l Pk.	900	F 6
Yountville	690	C 5
Yreka	3,227	C 2
Yuba City	7,861	D 4
Yucaipa	1,515	J 9
Zamora	60	C 5
Zenia	100	B 3

*No room on map for name.

appear dead level The Sacramento River which rises in the northern mountains drains the upper valley The San Joaquin whose headwaters are in the Sierra Nevada drains the south The two rivers join east of San Francisco and find their outlet to the sea through San Francisco Bay and the Golden Gate

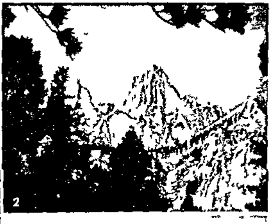
On the south the westward curving Sierra Nevada and the eastward curving Coast Ranges are joined by the Tehachapi Mountains which divide northern from southern California Southern California is a confusion of short ranges 6 000 to 9 000 feet high mountain rimmed valleys coastal plain and deserts Cajon Pass separates San Bernardino Range extending southeast and San Gabriel Range which runs east and west and includes Mount Wilson Farther south are the San Jacinto and Santa Ana ranges This region includes the coastal plain where Los Angeles lies East of the San Bernardino Mountains and south of the Sierra Nevada in an angle formed by the two ranges lies the Mohave Desert In the southeast too are Death Valley the Salton Sea and the Imperial Valley

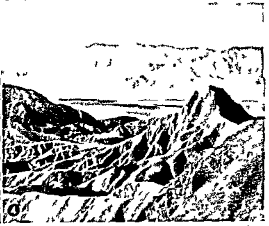
Near the Oregon border on the north the Sierra Nevada meets the Cascade and Klamath mountains (*see* Cascade Mountains) This northern extremity of the state is a region of volcanoes hot springs boiling mud pools and extensive lava flows Lassen Peak (10 453 feet) erupted from 1914 to 1921 after years of inactivity Mount Shasta (14 162 feet) is the lovely glacier-encircled cone of an extinct volcano

Nature s Fabulous Riches

Few lands have been so favored by nature as California Gold and oil in lavish abundance the majestic forests of sequoias and redwoods and a soil that will grow practically anything under irrigation are among its many blessings The climate and scenery are worth hundreds of millions of dollars every year for on them are based three of the state s big industries—moving pictures tourists and aircraft manufacture The moving picture pioneers came to the Los Angeles area to take advantage of the varied scenery of mountain sea desert and forests and the sunny weather for outdoor camera work

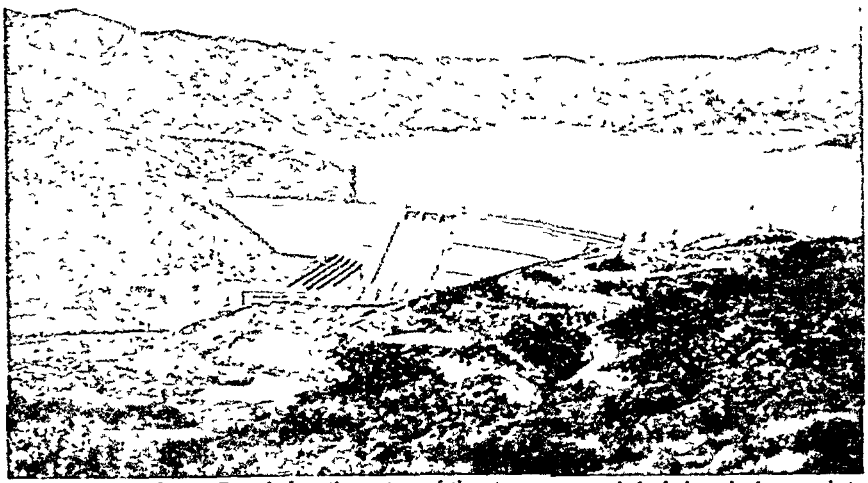
VARIED SCENERY OF COAST MOUNTAIN VALLEY AND DESERT



1 On Monterey peninsula south of San Francisco barren crags topped with misshapen trees jut out into the Pacific Ocean
2 In Sequoia National Park is lofty 14 495 foot Mount Whitney the highest mountain peak in the United States proper
3 Fruit and vegetables thrive in California s Great, or Central Valley In the distance are the Tehachapi Mountains
4 California has both the nation s highest and lowest points In Death Valley between the two ranges is the lowest point

SHASTA DAM, SECOND HIGHEST IN THE WORLD



This view shows Shasta Dam before the waters of the storage reservoir had risen high enough to pour over the spillway. Snowy Mount Shasta rises in the distance. The dam backs up the waters of the Sacramento River at the north end of the valley near Redding. It is the chief unit in the vast Great Valley irrigation, flood control, and hydroelectric program known as the Central Valley Project.

And "350 flying days a year" drew the aircraft manufacturers to the same region. Nearly 5 million tourists spend about 800 million dollars each year to enjoy the mild winters and summers of the coast and the many facilities for recreation. Superb highways make motoring a joy and help to give California the highest automobile registration of any state. People with automobiles can take a dip in the ocean in the morning and ski in the mountains in the afternoon. Residents of the interior valleys can escape the summer heat in an hour or two by driving to their cabins in the foothills.

Scenic Parks and Historic Memorials

Several national parks preserve for the entire nation the glories of the mountains and forests. They are Yosemite, Sequoia, Kings Canyon and Lassen Volcanic parks. The national monuments include Cabrillo, Channel Islands, Death Valley, Devils Postpile, Joshua Tree, Lava Beds, Muir Woods, and Pinnacles. (*See* Death Valley; National Parks; Sequoia; Yosemite National Park.) The large number of state parks set aside additional groves of redwoods and big trees, seashore, mountains, waterfalls, and canyons (*see* California Fact Summary).

The coast is rich in scenery and in memorials of the Spanish past—among them beautiful old missions, forts, and homes along El Camino Real (The Royal Road, usually called The King's Highway). The road runs from San Diego to Sonoma, north of San Francisco (*see* Roads; Southwest). Monterey, southeast of San Francisco, was the capital of Spanish California for most of the period between 1775 and 1846. Richard Henry Dana described the Monterey peninsula in his 'Two Years Before the Mast', and Robert Louis Stevenson at one time made his home here. Carmel, an artists' colony on the peninsula, has preserved the old Spanish charm by excluding modern utilities and architecture.

Climate

California has many climates, conditioned by the mountain ranges and foothills, distance from the ocean, and altitude. Within a few miles there may be sharp contrasts. In general there are only two seasons, a rainy winter and a dry summer. Annual rainfall varies from about 100 inches in the northwest to 2 inches in the southeast. Some of the valleys have only 25 to 35 rainy days a year. Others have practically no rain.

The Pacific coast and the mountain slopes facing the ocean enjoy cool summers and mild winters. The northern section is drenched with frequent and dense summer fogs. Here are the great redwood forests (*see* Sequoia), which require considerable moisture. Sufficient snow falls in the Coast Ranges during the winter to feed the short rivers throughout the year, but on the coast snow seldom falls and destructive frosts are few. The average temperature at San Francisco is 50°F. in January and 62° in September. The southern coast has one of the most equable climates in the world. Summers are warm and rainless. Rains fall in the winter, but almost every day sees some sunshine. The temperatures at Los Angeles average from 56°F. in January to 72° in August.

The interior valleys of central and southern California, which are shut off from the coastal winds, are extremely hot and dry in summer. Midday temperatures in the San Joaquin Valley around Fresno and Bakersfield, are 100°F. to 118°. The deserts of Mohave and Death valleys are even hotter. The dryness of the air lessens to some extent the discomfort of the heat. Winters are mild, with light precipitation, averaging only 6 inches annually at Bakersfield, and 9 inches at Fresno. The northern part of the Great Valley is almost as hot, but precipitation is greater, averaging 16 inches annually at Sacramento, and 37 inches at Redding near the foot of Mount Shasta.

The Sierra Nevada barrier in the east is invaluable to the state as a source of water. There, most of the precipitation takes the form of enormous snowfalls in the winter. At Tamarack the average is 451 inches, and in one year 884 inches fell. These snows are particularly important to the residents of the hot, dry valleys immediately below, for they melt and water

the fields and orchards in the summer and provide the cities with drinking water and hydroelectric power

Irrigation

California's valleys are immensely productive but only when they are liberally supplied with water. Without it they are deserts. Since the snows in the Sierra Nevada and in the Cascade Mountains begin to melt in the spring most of the water would run off by summer if it were not checked by dams and stored in reservoirs (*see* Dam). The Sacramento and San Joaquin, the principal rivers of the Great Valley both have their sources in the mountains. Most of their precious waters were carried out to San Francisco Bay in early spring. The thin streams left in summer proved inadequate for irrigation.

RICHES OF THE SOIL

Then in 1935 the multipurpose Central Valley Project was started. It was a long term plan for furnishing irrigation water providing drainage and improving river navigation. This successful project with its dams reservoirs and intricate canal systems also controls floods and furnishes hydroelectric power.

Shasta Dam was built at the north end of the valley to harness the waters of the Sacramento River. When completed in 1945 it was the second highest dam in the world. Just below it near Redding is Keswick Dam. At the south end of the valley Friant Dam northeast of Fresno controls the waters of the San Joaquin River. In 1948 work was begun on Folsom Dam 20 miles east of Sacramento. This huge dam is on the American River which empties into the Sacramento River.

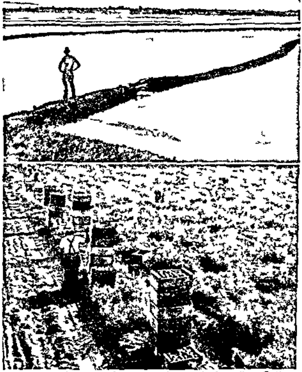
The O Shaughnessy Dam holding the Hetch Hetchy Reservoir on the Tuolumne River stores water for San Francisco 160 miles away. The Owens River in the south of the Sierra Nevada is diverted to the Los Angeles basin through a 233 mile aqueduct. The Colorado River is an even more important source of water for the Los Angeles area and for the extreme southeastern corner of the state. A 242-mile aqueduct brings the water from Parker Dam on the Colorado River to Lake Mathews. From there pipelines and tunnels distribute it to the 48 cities which comprise the Metropolitan Water District (*see* Aqueduct).

The 80-mile All American Canal irrigates the Imperial Valley replacing the old Imperial Canal which looped into Mexican territory. It taps the Colorado at Imperial Dam 300 miles below Hoover Dam. With its 130-mile branch north to the Coachella Valley it carries water to an additional million acres of one-time desert land. California has about 7 million acres under irrigation more than any other state.

In the heart of the Imperial Valley is the Salton Sea. This was once a salt-encrusted depression known as Salton Sink. In 1905 however the Colorado River broke loose in a wildly disastrous flood. Since the Imperial Valley is 250 feet below sea level the river tore out of the channel leading to the Gulf of California and took the steeper and shorter course down into the valley creating the present Salton Sea and the New River Gorge. The Colorado was not controlled and returned to its former bed until 1907. Hoover Dam up the river on the Nevada-Arizona boundary now prevents such floods and conserves water for irrigation.

Agriculture

California's diversity of climate topography and soil lets it grow virtually every fruit vegetable nut and cereal of the temperate or tropical zones. The value of its fruits and nuts far

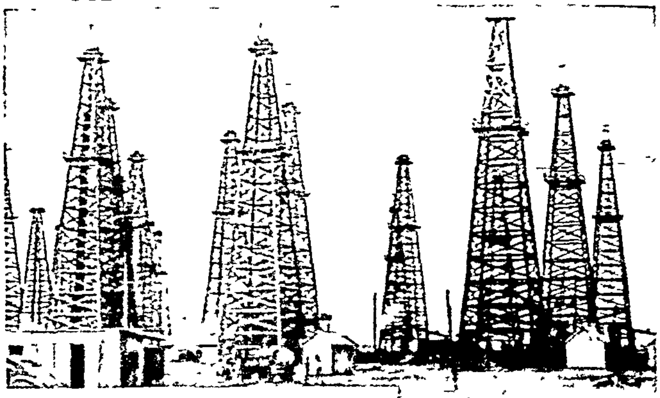


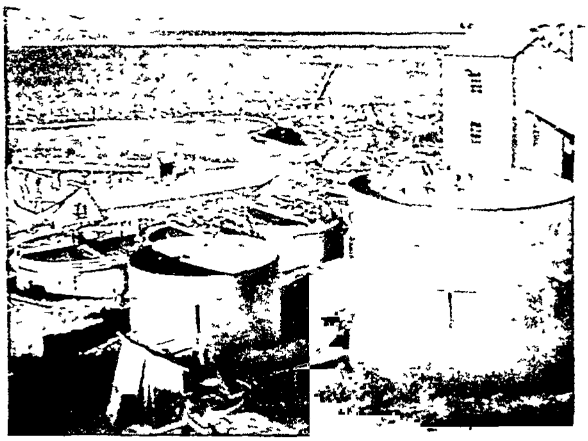
Oranges grow within sight of snow capped mountains in southern California a great citrus fruit region (top). The Sacramento River valley is one of the country's largest rice growing regions. In these irrigated paddies (center) the young spring rice is just appearing above the water. Migrant laborers harvest ripe tomatoes (bottom) near Woodland in the Great Valley famous for its huge vegetable crops

exceeds that of any other state and accounts for about two fifths of the total value of California's farm crops. From its orchards and vineyards come most of the nation's lemons, figs, persimmons, almonds, dates, and olives; about eight or nine tenths of its grapes, apricots, avocados, English walnuts, plums, and prunes; about half of its oranges; and about two fifths of its pears and peaches. California also packs one fourth of the nation's canned fruits and vegetables and is the world's greatest exporter of canned fruits and vegetables.

The Great Valley has about two thirds of the state's 37 million acres of farmland and accounts for one half the total value of farm products. The Los Angeles area is the center of the citrus fruit production. Other major growing regions are the valleys of the Coast Ranges and the one-time deserts of the southeast, which include the Imperial Valley and the more recently reclaimed Coachella Valley. These two valleys, with 365 growing days a year, produce great crops of dates, cantaloupes, lettuce, grapes, alfalfa, barley, and sorghum. Mountain pasture and feed from irrigated land give California important rank for livestock, wool, milk, eggs, and poultry. The state also raises much cotton, rice, potatoes, sugar beets, beans, tomatoes, lettuce, and carrots.

OIL AND GOLD IN LAVISH ABUNDANCE





Southern California bristles with oil derricks (top). The three major basins around Los Angeles, the San Joaquin Valley, and the coast make the state second only to Texas in oil production. Gold, in which California leads the country, is mined and refined at the Garden Queen mine (bottom). In the distance lies the Mohave Desert.

Large and Small Farms

California has two predominant types of farms. By far the greater number of farms have only from 3 to 30 acres and are cultivated intensively. Such farms are common around Los Angeles and to the southward. The small size is dictated by high land values and high costs of irrigation and cultivation. But even this size will yield a living for a family.

About two thirds of all the cultivated acreage, however, is contained within some 6,000 farms of 1,000 acres or more. These huge "factories in a field" are typical of the Great Valley. A 4,000-acre farm or ranch of this type represents a huge investment and costs many thousands of dollars annually to operate. It may be owned by a corporation and run by a manager, who employs perhaps 100 permanent laborers and 1,000 or more migrant workers during the harvests. A ranch often maintains its own packing and dehydrating plants. These valley ranches are operated with the machinelike precision of an automobile assembly line. Fields of wheat, barley, and alfalfa alternate with mile after mile of orchards and endless rows of vegetables. The flat expanses, uninterrupted by hill or fence, are admirably suited to mechanization. Even the airplane has become an agricultural implement, employed in rice planting and crop dusting. Much of the harvesting, however, must still be done by hand. The armies of migrant laborers move up the valley northward as the crops mature through the summer. These workers include Filipinos, Mexicans, Chinese, and at times farmers from the Middle West. Providing adequate shelter, schools, and medical service for the migrant families is a difficult problem.

Specialization in Farming

To facilitate marketing and utilize trained labor and management, California farms, both large and small, are highly specialized. Certain crops are centered in definite areas. For example, most of the raisin grapes are grown around Fresno. The district around Petaluma has been called a great egg basket, specializing in a certain breed of white chicken. Turlock is the melon center; Santa Clara the center for prunes; Watsonville and Salinas for lettuce. Rice is the special crop of the Sacramento Valley, and Kern County, in the San Joaquin Valley, grows long-staple Acala cotton. It has a higher yield to the acre than any other cotton district in the world. In total cotton production California now ranks among the leading states. The delta of the San Joaquin and Sacramento rivers, once a swamp, has been diked, drained, and planted in miles of aspara-

gus celery, and other truck crops In the foothills of the mountains cattle and sheep graze reminiscent of the days when California was a Spanish colony and hides, tallow, and wool were its only exports

Each major crop has its own marketing association, to which most of the growers belong The association operates processing plants where the product is graded and prepared for the market It purchases supplies for its members and carries on research to improve the quality of production

Minerals

The gold that started the frantic rush to San Francisco in 1849 is worth about as much today as the annual apricot crop California still is a leading gold producing state but much more valuable are its petroleum natural gas and natural gas liquids which together produce about nine tenths of the value of the state s minerals California is second only to Texas as the nation s source of petroleum The oil fields lie in three basins the San Joaquin with more than half the state s reserves the Los Angeles area with about a third and the coastal basin north of Los Angeles with about one sixth The oil boom opened in the 1920 s with the discovery of such fields as Huntington Beach and Signal Hill (Long Beach), although wells had been in production throughout the state since the 1860 s Output increased from 4 million barrels in 1900 to 263 million in 1923 Today the south coast region bristles with forests of oil derricks which day and night suck the black gold from the earth and even from the sea bottom off shore After the second World War production reached an all time high of about 330 million barrels a year

Cement is still another valuable mineral product in which the state is usually second to Pennsylvania Practically all the world s borax comes from the Mohave Desert region which includes Searles and Owens Lakes Potash salt soda magnesium compounds and many other chemicals are recovered from this same desert California is also a leader in the production of mercury sand and gravel tungsten, diatomite petroleum asphalt and natural iodine There are deposits of chromite manganese and gypsum More than 60 different minerals are produced and in total value of mineral production the state usually ranks third or fourth in the Union

THE GENERAL SHERMAN SEQUOIA

One of the largest and oldest living things on earth is the *General Sherman Tree in Sequoia* National Park. It is 272 4 feet high 36 5 feet in diameter, and 3 000 to 4 000 years old.

Fisheries and Forests

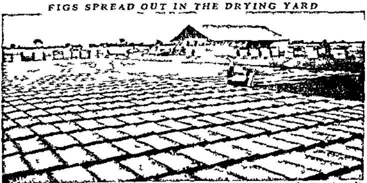
California s fisheries lead in value and production among all the states Marine fishing is carried on along the state s entire coast but great sardine and tuna fisheries off the southern coast account for 85 per cent of the total value of catch San Pedro a part of Los Angeles is the chief fishing port It has its own rail connections canning and by product plants and every facility for the shipment of fresh frozen and salted fish San Diego, San Francisco and Monterey are also fishing ports North of San Francisco salmon are taken The mountain streams offer fine trout fishing for sportsmen

The forests do not provide enough lumber for the state s needs and much of it must be imported to supply the saw and planing mills furniture box, and other wood product factories Most important of the remaining trees are the Douglas fir ponderosa pine true fir, redwood and sugar pine The redwoods which are relatives of the giant sequoias, have decreased in commercial importance as conservation projects rescue them from the saws of the lumbermen and include them in state and national preserves The national forest acreage is the largest in the country

Manufacturing

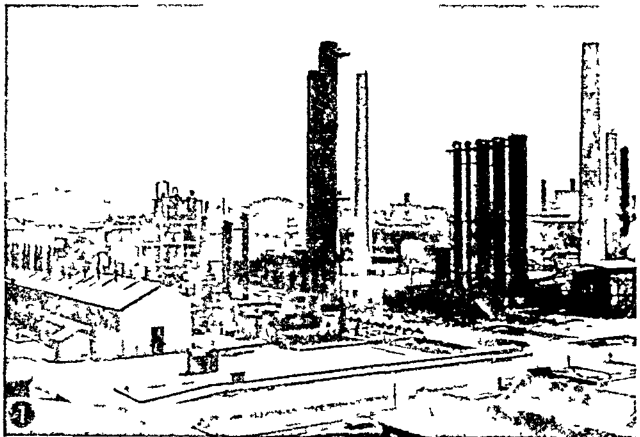
California owes its position among the ten leading manufacturing states in part to abundant oil and in part to its mountain streams which make it the greatest producer of hydroelectric power in the country Since there is little coal most of California s steam generated electric power is produced

FIGS SPREAD OUT IN THE DRYING YARD



Smyrna figs are grown near Fresno When they are ripe they are spread out on trays to dry in the hot sun. *Practically all the nation s figs come from this region.*

GROWING INDUSTRIAL POWER OF CALIFORNIA



1. Oil refineries like this one help make California a leader in the petroleum industry. 2. This worker is sterilizing and packing ripe olives, a food product in which the state leads the world. 3. This is an aircraft assembly line, showing wing construction.

with heavy fuel oil. The Los Angeles area is the largest industrial center west of Chicago (*see* Los Angeles).

California's huge food industry is the most important business in the state and approaches a billion dollars a year in the value of its products. California leads all other states in the canning of fruits, vegetables, fish, pickles, and sauces. More than half of all dried fruits come from California. The state also makes more than two thirds of all the wines and brandies manufactured in the United States.

The second largest industry in the state is the manufacture of transportation equipment. This group includes aircraft, motor vehicles, and ships. Southern California is the undisputed leader in the production of aircraft and equipment. The pioneer company was Douglas Aircraft, which opened its first plant at Santa Monica. Other large companies soon followed. The sunny, mild climate offers a maximum of good flying weather and is ideally suited to outdoor assembling. The automobile industry has many branch factories and assembly plants in California. Shipbuilding became important around San Francisco in the second World War (*see* San Francisco).

In petroleum refining the state is second to Texas. This industry is largely centered in and around Long Beach (*see* Long Beach), where California oil fields were first discovered and developed. (*See* Oakland; San Diego; Sacramento; Berkeley; Pasadena; Richmond; Glendale, San Jose; Fresno.)

The great forests of the west coastal states supply California's many sawmills and planing mills. California and Oregon are either second or third after Washington in lumber production in the nation.

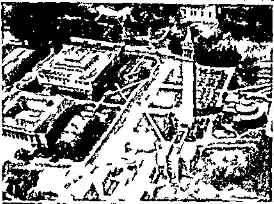
Other large industries are the manufacture of metal products and machinery and newspaper publishing. Designing and making women's clothing is an expanding industry. The tourist trade and motion-picture production are also important sources of the state's income.

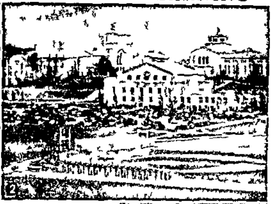
High Standards of Education

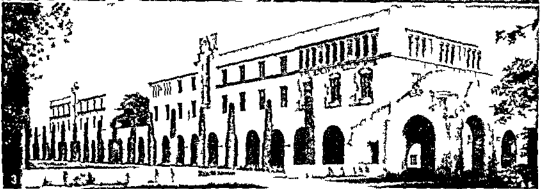
California is noted for its many fine public and private schools, colleges, and universities. In yearly expenditures for each pupil enrolled in public elementary and high schools, California is usually among the top-ranking states of the Union. These schools are supported by both local taxes and state aid.

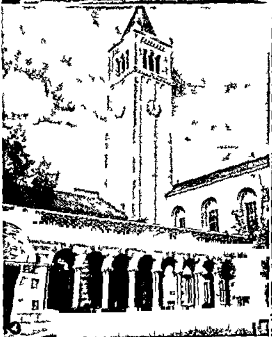
The University of California at Berkeley heads the state-supported institutions of higher learning (*see* Berkeley). It is one of the largest schools in the world, with eight campuses at Berkeley, Los Angeles, San Francisco, Davis, Santa Barbara, Riverside, La Jolla, and Mount Hamilton. The Scripps Institution of Oceanography is at La Jolla, and the Lick Observatory, at Mount Hamilton. The university's many colleges and schools include letters and science, agriculture, engineering, pharmacy, law, medicine, nursing, public health, and social welfare.

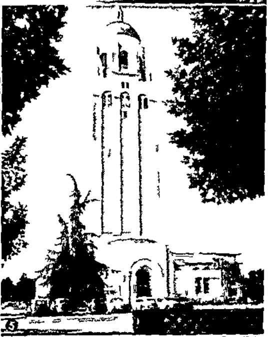
California State Polytechnic College is at San Luis Obispo. There are nine state colleges in California (*see* California Fact Summary).











1 An airview of the University of California campus at Berkeley The Sather Campanile rises in the center 2 The University of California campus at Los Angeles 3 The Charles Arms (left) and Seeley W Mudd (right) laboratories of the geological sciences California Institute of Technology Pasadena 4 Mudd Memorial Hall of Philosophy at the University of Southern California Los Angeles 5 Hoover Library on War Revolution and Peace Stanford University Palo Alto.

Stanford University, at Palo Alto, is one of the largest privately endowed universities in the country, and California Institute of Technology at Pasadena is one of the nation's leading scientific schools (*see* Pasadena). Other well-known institutions include the University of Southern California (Los Angeles), Mills (Oakland), Scripps and Pomona (Claremont), Redlands, and Whittier.

Thanks to outstanding staff members and ability to finance expensive research, California's institutions of higher learning have made notable additions to human knowledge. Astronomical research is implemented by the world's two most powerful telescopes—the 200-inch reflector at Mount Palomar and the 100-inch instrument on Mount Wilson (*see* Observatory) both in southern California. The University of California contributed to the unleashing of atomic power, using the cyclotron which had originated in its laboratories. Outstanding contributions have been made to biology, medicine, and many other sciences, and aircraft development has benefited enormously from aid given by various institutions.

A Leader in Literature

In literature, as in education, the state has long been a leader. Many a new writer has found inspiration and the encouragement of his first successes in California. Bret Harte and Mark Twain published their earliest work in San Francisco periodicals. In the *Overland Monthly*, of which Bret Harte became editor in 1868, appeared his famous short stories 'The Luck of Roaring Camp', 'The Outcasts of Poker Flat', 'Tennessee's Partner', and others. Mark Twain's first book, 'The Celebrated Jumping Frog of Calaveras County and Other Sketches', was written during his California residence. Joaquin Miller, poet of the west coast, made his home for 30 years in Oakland. Henry George wrote his treatise on the single tax, 'Progress and Poverty', while he was working on Sacramento and San Francisco newspapers. Helen Hunt Jackson's 'Ramona', a romance of the relations between Indians and whites, won lasting fame.

Other writers of the 19th century who did their best work in California were John Muir, Ambrose Bierce, Charles Warren Stoddard, Gertrude Atherton, and Gelett Burgess. Robert Louis Stevenson lived for a time in Monterey and in San Francisco, where he married Mrs. Osbourne. His story of the Napa Valley in 'Silverado Squatters' is one of his finest. Edwin Markham's 'The Man with the Hoe' was first published in a San Francisco newspaper.

Of the 20th-century writers, many of them associated with the literary and art colony of Carmel, the best known include Frank Norris, Jack London, Mary Austin, Harry Leon Wilson, Stewart Edward White, Wallace and Will Irwin, Charles and Kathleen Norris, Lincoln Steffens, Upton Sinclair, and Robinson Jeffers. John Steinbeck and William Saroyan are the best known of the younger writers.

HERE CALIFORNIA MAKES ITS LAWS

Legislators meet in the Capitol at Sacramento to write the laws that govern the state. The building is in a park landscaped with trees and shrubs from all parts of the world. The ball on top of the gold dome is 237 feet above the ground.

California's People and Government

California's history is one of striking population growth. When it became a state in 1850 California numbered but 92,597 inhabitants. One hundred years later it had 10,586,223 people. It climbed from the fifth most populous state in 1940 to the second in 1950. Its increase of 3,678,836, or 53.3 per cent, was the greatest of any state during that decade.

People have flocked to California for many reasons. "Forty-niners" sought gold. Others came to invest in a growing land boom. At the turn of the century, fruitgrowing and industrial expansion swelled immigration. During World War I more factories sprang up. In the prosperous 1920's moving pictures, an oil boom, and new industries attracted more thousands. Retired people found the climate ideal. In the depression of the 1930's came Dust Bowl migrants. During World War II aircraft plants and shipyards required thousands of new workers.

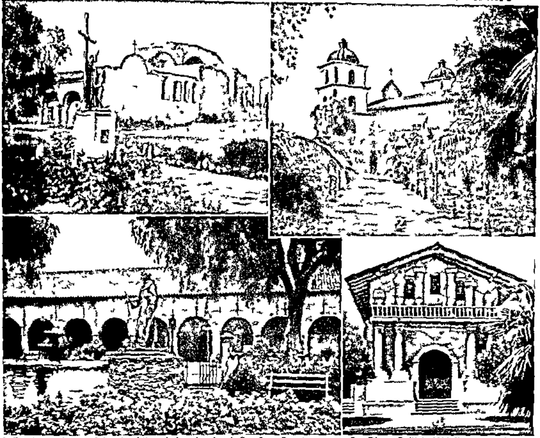
California's people are as varied as they are numerous. Chinese, Japanese, and Filipinos came in such numbers that Congress restricted the immigration of Orientals (*see* Immigration). During World War II, Japanese were put in camps. Mexicans form another large group. Most of the Indians live on reservations.

The second and much-amended state constitution, in effect since 1879, leans strongly toward popular control of government. Legislative power is controlled by initiative, referendum, and recall. "Lobbying" is a felony. The governor and state senators serve four years, and assemblymen, two years. Judges of the higher courts are elected for 12-year terms.

A History More Thrilling Than Fiction

The history of this fortunate region is as strange and poetic as the land itself. Within 50 years of Columbus' discovery of America, the Spaniards were

MISSIONS THE FRANCISCANS BUILT ON "THE ROYAL HIGHWAY"



1 Greatest and most elaborate of the mission churches is San Juan Capistrano near San Diego Built in 1806 it was ruined by an earthquake in 1812 The church and living quarters have since been restored 2 This is the gateway to the Santa Barbara mission built in 1786 now Franciscan headquarters for the Pacific coast 3 A statue of Father Junipero Serra stands in the courtyard of San Fernando mission near Hollywood 4 Mission Dolores, founded in 1776 was one of the first buildings in San Francisco

pushing northward, lured by Indian tales of cities richer than those of Peru and Mexico and the Montalvo romance of a fabled island named California, full of gold and pearls.

Hernando de Alarcon saw a part of California when he sailed 200 miles up the Colorado River in 1540 in an attempt to contact Coronado's land expedition to the 'Seven Cities of Cibola' Two years later Viceroy Mendoza of New Spain sent Juan Rodríguez Cabrillo up the west coast in search of a strait across North America connecting the Pacific and Atlantic oceans On Sept 28 1542, Cabrillo entered beautiful San Diego Bay, the first white man to land on the California shores He and his pilot, Bartolome Ferrelo, who succeeded him after his death in 1543, charted many of the coast's important landmarks and claimed them for Spain

Sir Francis Drake, the English sea rover, sailed his *Golden Hind* up the California coast in 1579, seeking a passage into the Atlantic He anchored in a bay 30 miles north of San Francisco, later named Drake's Bay, and called the land New Albion because of its white cliffs reminiscent of the white cliffs of England According to his chaplain's account he nailed to a faire great poste a brass plate claiming New Albion in the name of Elizabeth I

In 1936 357 years later the plate was discovered by picnickers It was turned over to Professor Herbert E Bolton historian of the University of California who deciphered the following lettering

> Bee it knowne vnto all men by these presents Ivne 17 1579 by the grace of God and in the name of Herr Maiesty Qveen Elizabeth of England and Herr svccessors forever I take possession of this kingdome whose king and people freely resigne their right and title in the whole land vnto Herr Maiesties keepeing now named by me an to bee knowne vnto all men as Nova Albion Francis Drake

This plate is now in Bancroft Library of the University of California at Berkeley

Sebastian Vizcaino recharted the coast in 1602 and gave many places their present names San Diego, Santa Catalina, Santa Barbara, Monterey, Carmel, Point Conception He sailed as far north as Cape Mendocino but, like other navigators before him, missed the narrow entrance to San Francisco Bay

Monterey he described as a "natural port, well north of New Spain, where navigators might find refuge."

For the next century and a half, beautiful and fertile California lay isolated behind its mountains and deserts. Except for an annual visit to Monterey of a Spanish galleon on its way from Manila to New Spain, the land was undisturbed. Late in the 18th century, with the English advancing across North America, and Russian explorers in Alaska threatening to extend their fur-trading posts southward, Spain decided that Upper California must be colonized.

The Spanish Settlements

Two great pioneers carried out this plan—Don Gaspar de Portolá, a resourceful soldier, who had been governor of Lower California, and Father Junípero Serra, a crippled but courageous Franciscan monk. Five groups set out from Lower California, three up the coast in ships carrying food and church furnishings; two by land, bringing horses, cattle, and mules. With one ship lost at sea and half the expedition dead or suffering from scurvy or famine, they met at San Diego in July 1769. Here they founded the Presidio of San Diego and the first of Father Serra's nine missions, San Diego de Alcalá. Portolá, traveling north by land toward Monterey Bay, failed to recognize it and in November 1769 came to the southern arm of San Francisco Bay, which a scouting party under José Ortega discovered. Returning to San Diego exhausted and starving, Portolá and his men were ready to give up. Father Serra persuaded them to wait one more day for a supply ship. It arrived, and the little party was saved.

Traveling north again, Portolá came to Monterey Bay, where he built the Presidio. Father Serra, who joined him by sea, founded the mission of San Carlos Borromeo del Rio Carmelo, or Carmel Mission (1770). This became Father Serra's headquarters.

In 1772 Father Serra walked the 2,000 miles from Carmel to Mexico City and back to recommend further settlements in Upper California. Juan Bautista de Anza, sent to open an overland route, brought the first settlers across deserts and the high Sierra Nevada to establish San Francisco Presidio (1776). Other settlements were made at San José (1777) and Los Angeles (1781), and pueblos grew up around these and the various missions.

Father Serra lies buried in the sanctuary of Carmel Mission beside his friend, Father Juan Crespi, who kept a diary of their expeditions, and Father Fermín Francisco de Lasuén, successor to Father Serra and founder of nine more missions.

California's Golden Age

The half century from the founding of the missions to the end of Spanish rule (1769–1821) was a "golden age" of California. The chain of missions extended up the coast along El Camino Real, each link a day's journey from the next one. Peaceful indeed was this road as it wound between the mountains and the ocean. Each mission with its white walls and red-tiled roof was built around a central plaza, hedged with roses, and set within silvery olive orchards, orange groves, and waving grain fields. An arcade of stone and adobe facing a courtyard ran along in front of living rooms, granaries, and schools. The Spanish architecture of the missions and of the civilian towns (pueblos) was distinguished by heavy roofs, thick walls, and small window spaces. It warded off the heat and glare of the sun so well that it is widely used today for California homes. The missionaries selected every site with a keen eye for fertile soil and water for irrigation. They started the cultivation of fruit trees in California. Among the richest missions were San Luis Rey, founded in 1798 near Oceanside and since restored as a Franciscan college, and San Luis Obispo, founded in 1772.

True to his vow of poverty, the Franciscan lived austerely; a rawhide bed, a rude chair and table, and a crucifix were his only furnishings. But in the mission churches, costly images, rich brocades, mirrors, and silver candlesticks dazzled the Indians. A traveler can still see some of these at San Juan Bautista (1797), not far from Salinas.

When the Spaniards came the semicivilized Indians lived in mud-brick dwellings and followed primitive customs. The priests, or *padres*, clothed them in wool, taught them to build better homes, and to earn meat and bread by useful crafts such as leather and metal working. The missions became the backbone of the social and industrial life of Spanish California. Fiestas, or religious festivals, and berry-picking holidays lightened the drudgery. Old customs survived longest at the San Gabriel mission (1771), a half hour from Los Angeles, where a Mission Play is given every year.

Life was pleasant on the great ranchos granted to army officers and other favorites of the king or of the viceroy of New Spain. Families were large, but cattle and sheep roamed the hills and food was plentiful. Many household tasks were done on the verandas around the central *patios* or courtyards of the houses. The annual supply ship from New Spain brought tools and implements, brass and silver ornaments for church and home, silks, velvets, and brocades for church vestments and fine garments. But the colonists' wealth was in their herds. They made their own linen and woolen cloth, harnesses and saddles, soft moccasins, and the chairs and bedsteads of wood and rawhide. They ground their own corn meal and flour. They enjoyed frequent *meriendas*, or picnics. Dancing and open-handed hospitality prevailed at the annual rodeos, when livestock was rounded up and branded.

For the Indians, life was not so agreeable. Many were never wholly resigned to mission life, or to virtual slavery on the *ranchos*. Measles, pneumonia, and other European diseases killed great numbers, and caused a superstitious terror of white men. Frequent revolts were brutally suppressed by the soldiers stationed at the presidios.

From Mexican to American Rule

When the Mexicans won independence from Spain in 1821 and took control of California, they halted the work of the Franciscans, and in 1833 began to

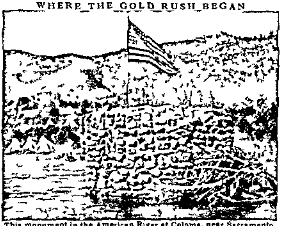
secularize the missions. Seizing church lands they allowed the fields to run to weeds, and permitted 30,000 Indian converts to resume native customs.

The grip of Mexico soon weakened, however, as foreign influence grew. British ships anchored in California harbors. France and Russia also looked upon the province with interest.

As early as 1796, Ebenezer Dorr, a Boston skipper, sailed into Monterey Bay and traded with the settlers. Other Yankee captains followed him despite Spanish laws against foreign trade. They bargained for sea otter furs, wheat, wool, hides and tallow, in exchange for American goods. One such visit is vividly described in Richard Henry Dana's 'Two Years Before the Mast'.

American fur trappers began to enter from the east. Jedediah Smith, one of these frontiersmen, braved blizzards and starvation in the high Sierras to scout the Cajon Pass into southern California in 1826. He explored the Sacramento Valley northward into Oregon. Joseph Walker, another trapper, discovered Yosemite Valley and the Walker Pass into San Jacinto Valley. Some of the traders and trappers married daughters of California *rancheros* and gained influence in the province. Others returning east, spread word of the rich land whose Mexican rulers were too incompetent to defend it.

WHERE THE GOLD RUSH BEGAN



This monument in the American River at Coloma, near Sacramento, marks the site of the sawmill where James W. Marshall, an employee of Captain John A. Sutter, discovered gold in January 1848

Russia also had recognized the weakness of the Californians. Coming to San Francisco in 1806 to buy supplies for the fur trading post at Sitka, Alaska, Nicolai Petrovich Rezanov paved the way for the establishment, six years later, of Rossiya, an outpost near the Russian River north of San Francisco. He became engaged to Concepcion Arguello, daughter of San Francisco's *comandante*, but died while crossing Siberia to obtain the czar's consent to his marriage with a woman of another faith. When Concepcion learned of his death she entered a convent. Gertrude Atherton has told their story in her novel 'Rezanov'.

Supplies for Sitka were grown or purchased at Rossiya after 1812, and a wealth of seal and sea otter furs was shipped to China. In 1841, convinced that California would soon belong to the United States, Russia sold Rossiya (now Fort Ross) to John Augustus Sutter.

Captain Sutter (1803–80) was a resourceful pioneer of Swiss parentage, who ruled like a feudal lord over 97,000 acres of land in the Sacramento Valley. He built a fort against the warlike Modoc and Klamath Indians. There, Americans coming overland found haven after their difficult journeys (*see* Sacramento). This Great Immigration reached its height by 1854. Its most tragic disaster befell the Donner party, whose 45 survivors of an original 87 were rescued from blizzards in the Sierra Nevada by Sutter's guides early in 1847.

Sutter's part in Americanizing the section was not so important, however, as that of John C. Frémont (1813–90), son-in-law of powerful Senator Thomas Hart Benton of Missouri. Frémont had already won national fame by being the first to make a scientific survey of the Pacific coast and by writing vividly of his explorations. Frémont refused the Mexican command to leave California and prompted American settlers to proclaim at Sonoma in 1846 the short-lived "Bear Flag Republic."

In that same year the United States had declared war against Mexico and in a few sharp fights the invading army under Gen. Stephen Watts Kearny took California. By the treaty of Guadalupe Hidalgo (1848) the United States gained California. Two years later, it was admitted to the Union (the 31st state) as a part of the Compromise of 1850. (*See* Compromise of 1850, Far West, Southwest, American.)

William H. Seward referred to the new state as "the youthful queen of the Pacific, in robes of freedom gorgeously inlaid with gold." In 1847 Frémont refused to recognize the authority of General Kearny who had assumed the office of governor. Frémont was court-martialed and left the army. He continued his turbulent and ambitious career as senator from California (1850–51), as first presidential candidate of the Republican party (1856), as major general during the Civil War, as railroad builder and victim of the financial panic of 1873, and as governor of Arizona (1878–83). (*See* Fremont.)

The Brawling Days of '49

In 1841 James A. Dana had found gold in northern California. The next year Francisco Lopez, a sheepherder, had discovered gold near Los Angeles and caused a little excitement. But it was on Jan. 24, 1848, that James Marshall, a carpenter at John Sutter's sawmill, found gold in the millrace in the American River and started the famous California gold rush.

All parts of the nation shared in the excitement. Crews deserted their ships, farmers dropped their plows and merchants nailed up their stores to rush out to California. Americans came by three routes: around

Cape Horn, across the plains, and across the Isthmus of Panama. The swiftest California clippers made the Cape Horn trip in three months, carrying fortune seekers able to pay dearly for fast passage, but ordinary ships took six to nine months for the voyage. Hardy pioneers traveled overland, taking with them their cattle and farm implements. Prairie schooners assembled along the Mississippi and in Kansas, organized in great caravans for protection, and lumbered over little-known trails toward the setting sun.

About 50,000 immigrants started out in the spring of 1849, eager to cross the Sierras before snow blocked the passes. Salt Lake City, just settled by the Mormons, was a half-way station on the long and dangerous journey. Countless "forty-niners," well equipped and expertly guided, made the five months' trip without mishap. But other thousands were killed by Indians or died from cholera and scurvy, thirst and hunger while crossing the parched deserts and climbing the long winding trails over the Sierras. Shallow graves and the bleaching bones of cattle marked the way. Because the Panama route was shortest and seemed easiest, it was most crowded, but hundreds died of fever while crossing the isthmus.

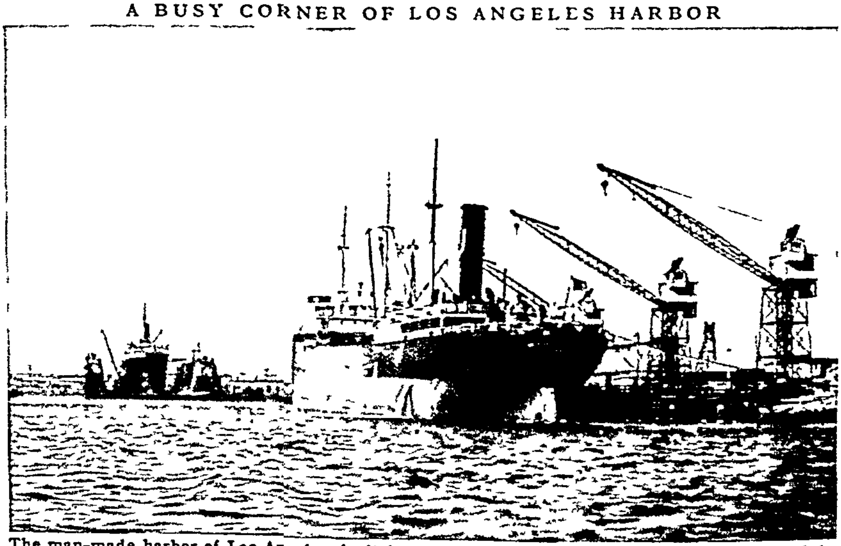
In San Francisco bearded, roughly-clad miners swaggered about with six-shooters and bowie knives stuck in their belts. Most of the people lived in tents and shacks, for the population jumped from 800 in 1848 to 25,000 in 1850. Fire swept the city six times in those brawling days. Prices soared. Good boots cost $100, and a dozen eggs $6. Everyone expected to be rich tomorrow or the day after. Gaudy gambling dens sprang up. The Vigilance Committee of prominent citizens twice drove thieves and gamblers out of town (in 1851 and 1856), and quickly ended the careers of murderers by hanging them.

When California was admitted into the Union as a free state in 1850, it was very different from the dreamy California of the Spaniards. Stagecoach lines and the Pony Express kept it in touch with the East. Miners gathered $65,000,000 in gold every year from 1850 to 1853. Before long the gold in the stream beds became scarce. In ten years most of the adventurers, who lacked machinery for deeper digging, had shouldered their picks and left for the Nevada silver mines, owned chiefly by San Franciscans. Others became homesteaders, or settled as "squatters" on former Spanish and Mexican ranchos. These early grants, loosely defined, caused many disputes. John Sutter, whose lands were overrun by the gold seekers, died in poverty trying to prove his title to his property. The federal government tried to redistribute the lands justly, but many native Californians were defrauded by local officials.

Although the first telegraph line was established in 1861, the state remained isolated during the Civil War. Pro-Southern sentiment was strong; but a plot to seize army and navy posts was thwarted, and California contributed many soldiers and much gold to the Northern cause.

The Central Pacific Railroad, now the Southern Pacific, was completed in 1869, encouraging settlement on a large scale. It is a monument to the vision of Theodore Judah, civil engineer, who died in 1863 after exploring a practical route for it across the Sierra Nevada, and persuading the "Big Four" (Leland Stanford, Charles Crocker, Collis P. Huntington, and Mark Hopkins) to invest in it. After 1870, however, the railroads began to dominate the state. They controlled the legislature and owned the huge tracts of land granted by the government to encourage their development. High freight rates, interest, and taxes oppressed farmers and businessmen, as described in Frank Norris's novel, 'The Octopus'. A frenzy of speculation followed the opening of the Comstock silver lode in Nevada in 1872. The Bank of California failed in 1875, a panic followed, and people lost homes and farms. Dennis Kearney organized the Workingman's party, which urged a new constitution. One was adopted in 1879 and provided for control and taxation of railroads and other public utilities.

A BUSY CORNER OF LOS ANGELES HARBOR



The man-made harbor of Los Angeles, built between 1910 and 1914 with federal aid, is one of the largest and busiest in the world. Its annual commerce is worth hundreds of millions of dollars in incoming bananas, tin, sugar, rubber, coffee, and outgoing oil, canned foods, aircraft, and cotton.

The Changing Scene

The 20th century has seen a great development of natural resources and industry, and enormous population increases. Southern California especially has

seen a series of spectacular booms that dwarfed the gold rush of 1849 (*see* Los Angeles)

Labor and racial troubles have cast a shadow over the scene Resentment against the growing Chinese populat on had led to race riots in the 19th century In the 1900 s Japanese laborers poured into Californ a and acquired farm land Fear of the new yellow peril prompted further restrictions on imm gration of Oriental r ices (*see* Immigration)

During and after the first World War antilabor sentiment was strong Labor un ons in Los Angeles had been repressed since 1910 when 20 men were k lled in the bombing of the *Times* building luring a lockout of the paper s typographers In 1916 Thomas J Mooney and Warren K B llings labor organizers were arrested for alleged participation in the bombing of San Francisco s preparedness day parade Labor sympathizers throughout the country agitated for their release but Mooney was not pardoned and Billings did not have h s sente ce commuted until 1939

The depression and drought of the 1930 s brought new problems with the flood of m gratory farm laborers from the Dust Bowl of the Middle West In 193 work began on the Central Valley Project to aid agr culture by diverting surplus waters of the Sacramento in the north to the San Joaquin basin in the south

Industrial growth during and after the second World War attracted many people creat ng educa tional housing transportation and other problems (*See also* chronology in California Fact Summary United States section South Pacific Region)

CALIFORNIA LOWER The great Mexican pen n sula called Lower Californ a (Baja California) was discovered by white men about 1533 It s nearly the size of Florida but it has only about one tenth as many people It is mostly a mountain ridged desert 750 miles long and from 30 to 150 m les wide enclosing the Gulf of California The area of about 55 629 square miles is almost equally divided into a state and a territory Mexicali capital of the state of Baja Cal forn a Norte in the north has a populat on of 64 658 La Paz capital of the territory of Baja California Sur in the south has 13 081 inhabitants

Mountains r ch in minerals are guarded by grim des erts Railways and good roads have been built only in the extreme north Mines therefore are developed near ports where boats can pick up the ore Santa Rosalía on the Gulf is the copper mining center

Many regions go several years without rain Crop lands are few The most important lie in the Mexicali region wh ch is irrigated from the Colorado River and grows cotton and wheat Valleys near the Pacific port of Ensenada produce wheat beans chilies and fruits The peninsula s southern tip exports winter peas and tomatoes to the United States

The fisheries off the Pacific s de notably at Mag dalena Bay yield big catches of tuna mackerel and sardines The fisheries in the Gulf of California keep a large cannery busy at San José del Cabo La Paz also on the Gulf is a world market for pearls taken from the Bay of La Paz and its vicinity

Tijuana just below the United States border is a popular resort for Californians Ensenada about 65 miles by road from Tijuana boasts fine beaches and excellent fishing The first known expedit on of wh te men to Lower California was ordered by Cortez in 1533 In 1697 the first permanent white settlement was estabi shed by Jesuit miss onaries to the Indians Populat on (1950 census preliminary) 287 308

CALORIE One of the units used in measuring heat is the calorie A kilogram calorie or greater calorie is the amount of heat requ red to ra se the temperature of one kilogram of water one degree cent grade A gram calorie or lesser calorie is the amount re quired to ra se the temperature of one gram of water one degree (*See also* Food Heat)

CAL'VIN JOHN (1509–1564) When John Calvin was a boy in France Martin Luther revolted against the Roman Cathol c church touch ng off the Protestant Reformation in Europe Calvin grew up to suc ceed Luther as leader of this movement Followers of the two men known as Lutherans and Calvinists formed the major branches of Protestantism

In his youth Calvin studied in Paris for the pr esthood but as Luther s ideas spread in France he grew unsettled in his religious convict ons and turned to law When he was about 22 years of age he experi enced a convers on and felt himself divinely called to forsake the Catholic church for a simpler form of Christianity In The Institutes of the Christian Rel gion he stated his new religious ideas with such vigor that the book became a rallying point for Protestants all over Europe

Because of his heretical ideas Calvin was obliged to flee France On the advice of his friend Guillaume Farel who had a strong Protestant following in Geneva Calvin in 1536 took up residence in the Swiss city and there he remained almost continuously until his death in 1564

Under the iron will of Calvin Geneva became a city of God In the social life of the community Calvin enforced the ideals of purity simpl city and devout religious faith He was consulted in all civic as well as religious matters and Geneva owes to him its fine university and several of its thriving industries Although his uncompromising severity led him to approve such acts as the burning of Michael Ser vetus a religious teacher who e views he abhorred Calvin made Geneva one of the most influential cities in Europe

Calvin s teachings are the basis of the Presbyterian and Reformed churches They spread among the Huguenots of France the Protestants of the Nether lands and Scotland and the Puritans of England The English Calvinists unable to practise their reli gion at home came to the New World in the 17th century These Pilgrims laid the foundation for Calvinism in the United States

CAMBRIDGE MASS Although it has become one of the most important manufacturing cities of New England the chief fame of this suburb of Boston separated from it by the Charles River is as an

historical, educational, and literary center. The site was settled as New Towne in 1630. It was planned as the capital of the Massachusetts Bay Colony, but soon Boston was chosen instead.

Harvard College was founded in Cambridge in 1636 with a General Court appropriation of £400. John Harvard, a minister of near-by Charlestown, bequeathed his library and £1,700 to the project. The college was named for him, and in 1638 the town was renamed for England's Cambridge University. Harvard was the first American college, and today it is in the first rank of universities. An association of Harvard professors in 1879 informally established Radcliffe College for women. It has long been independently administered but is still affiliated with Harvard. The Massachusetts Institute of Technology, founded in 1861 and opened in Boston in 1865, moved to its present 80-acre campus in Cambridge in 1915. Three theological seminaries also are here.

Thus Cambridge has remained a center of American *cultural life. Among many famous writers, teachers,* and scientists who have lived and worked here are James Russell Lowell, Henry Wadsworth Longfellow, Oliver Wendell Holmes, John Fiske, Louis Agassiz and his son Alexander, and Margaret Fuller, an ardent feminist of the 1800's. The charm of Old Cambridge, the southwest portion of the present city, lies in its historic sites, old homes, and spacious parks. Until 1923 the Washington elm stood on the Commons. Under its spreading branches George Washington assumed command of the Colonial army. Craigie House served as his first headquarters; afterward the house was Longfellow's home (for picture, *see* Longfellow). The three-story, gambrel-roofed Brattle Mansion, built in 1727, was Margaret Fuller's home; it now houses the Cambridge Social Union. Lowell was born and lived throughout his life in Elmwood, a three-story clapboard mansion built in 1767. Many other fine buildings and school and other museums are points of interest.

Until the beginning of the 1800's, Cambridge was occupied largely with the housing, feeding, and teaching of college students. Then the manufacture of soap, coffins, glass, carriages, ladders, and books and pamphlets began. Today most of these products as well as ink, machinery, rubber goods, candy, and wire cable are produced. Industry has reclaimed the mud flats along the Charles River and has spread to other parts of the city. In 1912 a subway to downtown Boston was opened. Cambridge's water supplies and sewage disposal, like those of other Boston suburbs, are controlled by a metropolitan commission. In 1940 Cambridge adopted the council-manager form of government. (*See also* Massachusetts; Boston.) Population (1950 census), 120,740.

CAMDEN, N. J. Its location across the Delaware River from Philadelphia shaped Camden's growth. Its first settler, probably William Cooper, built a cabin on the Delaware River bank near the mouth of the Cooper River in 1681, the year before Philadelphia was settled. Philadelphia grew rapidly, and Cooper and others who operated ferries to the new city called the settlement Cooper's Ferries.

The settlement grew slowly, and it was not until 1773 that a descendant of Cooper platted the town and named it Camden, after the first Earl of Camden. The Revolution halted development. During the British occupation of Philadelphia, Camden served as a British outpost; several skirmishes were fought here.

By 1810 steamboats had replaced the hand-operated ferries. But Camden's real growth began in 1834 when the Camden and Amboy Railroad began operating through it between New York and Philadelphia. *Many small industries preferred Camden to Phila*delphia. In 1858 a factory for making steel writing pens, still one of the city's products, began operation. After the Civil War new factories rapidly filled the river bank. The Atlantic Ocean lies only 90 miles down the river and across Delaware Bay; Camden therefore became a port and shipbuilding center.

After the Delaware bank filled with factories new ones spread through the city and along the banks of the Cooper River. Today Camden's manufactures include ships, radio and television sets, canned foods, textiles, chemicals, books and magazines, and iron and steel products.

Rail-car ferries still cross the river, but in 1926 a great vehicular bridge to Philadelphia was completed. Later, rails for the Philadelphia subway trains were laid on the bridge. Many of Camden's streets are little more than narrow alleys. But the city's red and yellow brick houses and streets are kept tidy and clean. On one of the streets is preserved the house in which Walt Whitman spent his last years (*see* Whitman, Walt). Marshy land has been reclaimed for parks; in Pyne Poynt Park stands one of the Cooper houses, built in 1709. Camden is the seat of the College of South Jersey, affiliated with Rutgers, and a state teachers college.

Camden was incorporated as a city in 1828. It was made the county seat when Camden County was formed in 1844. The South Jersey Port Commission operates the city's port facilities. Camden's government is the commission form. (*See also* New Jersey.) Population (1950 census), 124,555.

The FOUR-FOOTED "SHIP *of the* DESERT"

CAMEL. One of the most useful of all animals is the camel. For thousands of years it has helped men to live in the deserts of Asia and Africa. It can travel great distances over hot sands and go for days without water, carrying a man or a load of freight. So it is no wonder men call it "the ship of the desert."

Until motor cars and airplanes were invented, the camel was the only means men had for crossing the hot deserts of Asia and Africa. The camel supplies food and many valuable materials to desert dwellers. For weeks at a time they may live on thick cheesy camel's milk and on the meat of young camels.

They use fat from the hump in place of butter They make camel's hair into tents blankets, rugs, clothing rope, and cord Dried camel droppings supply fuel for cooking fires And when the camel dies, desert dwellers use its hide for making sandals, water bottles, and many *other articles*

In spite of the camel s usefulness, it has no friends It is ugly looking and ill-tempered and stupid as well But the camel is wonderfully made for the work it has to do No other animal can live and carry great burdens in so hot and dry a climate on such scant supplies of food and water

The camel's most striking feature is the large hump on its back (or as in the case of one kind of camel, the Bactrian, two humps) The hump is formed of fat and muscle without any bone If the camel has to go without food for a period of time, the fat in the hump can nourish it for several days Its legs are so long that when it stands, its hump may be seven feet above the ground Its knobby knees other leg joints and chest have pads of callus The pads cushion the camel as it kneels in the rough sand Each foot is split into two long, hoofed toes that spread wide under its weight Under the toes on each foot is a thick pad and these keep the camel from sinking in loose sand

HOW THE CAMEL IS ADAPTED FOR DESERT LIVING

The camel s legs can carry from 500 to 600 pounds more than its own weight It can go for days without eating taking energy from fat stored in its hump Its long neck can reach down so it can graze on the short grass found in oases The close ups below show other body parts

The camel s dark eyes are good for seeing in glaring desert sunshine The nostrils can close to slits to keep out blowing sand Thick calluses on the knees prevent rasping or cutting when it kneels Two large toes on each foot act like snowshoes to support it on loose sand

The camel's body is covered with a shaggy, sand-colored coat The hair sheds in great handfuls giving a perpetually frowsy look A dense fringe of hair hangs from the long, curved neck The eyes are its only claim to beauty They are large, brown, and melting A long, double fringe of interlocking eyelashes protects the eyes from sand storms and the glare of the desert sun

The camel's nostrils are slanting slits that can open wide to draw breath or close to keep out blowing sand It has long jaws with sharp teeth The lower jaw swings sideways as it chews its cud (The camel is a *ruminant* related to cattle, sheep, deer, and the other cud chewers) The lips curl upward, giving it a look of haughty superiority The upper lip is cleft in the middle like a harelip With the two parts, as if with two fingers, it grasps and feels its food

Many a desert dweller owes his life to his camel Driven by thirst he can kill the animal if necessary and obtain a gallon or more of precious water

We often hear exaggerated stories about the camel's going without water But it can do so for some time by storing water in its peculiar stomach As a cud-chewing animal, the camel has three stomachs It uses the first one to store food as it grazes and to

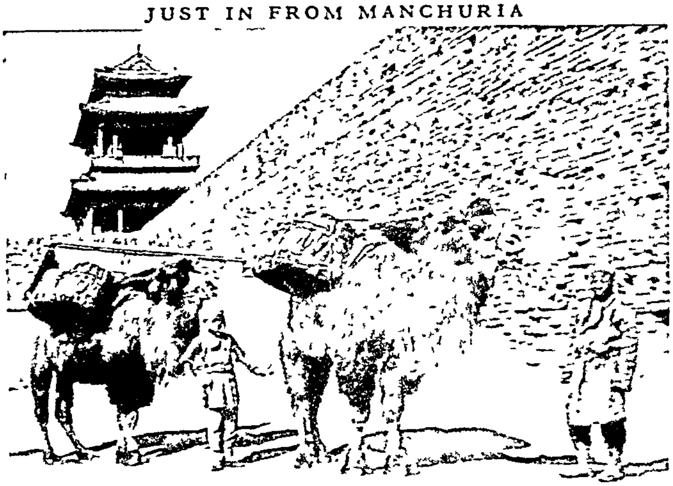
form it into a cud. The second supplies digestive fluids; and the third stomach digests chewed cud. The first two also have pockets in the walls for storing water and muscles to hold the pockets closed when they are filled. The muscles can open and close to let out water whenever the camel needs it.

Before starting out on a long journey, a camel driver forces the animal to drink about 15 gallons of water by giving it salt to increase its thirst. With a light load and traveling slowly, a camel can go without water for six to ten days.

The Camel's Dainty Appetite

After a day's travel, a camel driver gives his animal a small measure of hard dates or dry beans. If the camel forages for itself it eats any twigs, thistles, and thorny shrubs it can find. Camels will eat almost anything. They will chew tent cloth or their own leather bridles. They consider an old mat or basket a great delicacy.

JUST IN FROM MANCHURIA



Two double-humped (Bactrian) camels reach the walls of Peking carrying baskets of produce from the rich fields of Manchuria. (Compare them with the single-humped Arabian camel pictured on the previous page.) The long shaggy hair of the Bactrian protects it from the bitter cold of its native Central Asia; it is also shorter and sturdier than its cousins, and its shorter legs and harder feet are well adapted to its rocky hilly country.

Although men have used camels for at least 4,000 years, the animals never have become fully domesticated as cattle have. Camels remain as untamed and sullen as the desert itself. One of the few things a camel can be taught to do is to kneel at its master's command. It seldom works without a protest. The uproar in a camel yard when a caravan is being loaded is deafening. The animals express their rage with peculiar bubbling bellows and by biting, kicking, and spitting. Their favorite trick is to take sly nips at their masters.

Only the Baby Has Any Appeal

There is just one thing a camel will love. The mother camel shows affection for her baby. She bears one calf at a time, 11 months after breeding. The infant stands about three feet tall on his long, thin legs, and he is so weak and wobbly that he can scarcely walk. But a day after birth he can follow his mother to pasture. Without her milk he would die. If the mother has to go with a caravan, the helpless baby is put into a hammock and swung from one side of a big freight camel called a nurse. The nurse may carry a quarter of a ton of other things besides—leather bags of water, bales of cloth and dates, jugs of oil, and blocks of rock salt.

The baby isn't put on his mother's back because she is too stupid to understand this. If she could not see her baby, she might think he had been left behind. Then she would bolt for the last camping place. When the baby is on the nurse-camel, she can see him, and she follows contentedly. After the day's march she has him all to herself. She nurses him and nuzzles him with her sensitive harelip. The baby cuddles up to her for warmth, for after the terrible heat of the day the desert nights are often cold.

In their third years, camels have grown big enough to carry heavy loads. They can keep this up for 15 or 20 years, and they can do lighter work until they are 30 years old or more. Some camels live to be 50 years old.

The "Ship of the Desert"

A baggage camel is expected to carry 500 to 600 pounds and travel 25 miles a day. A special breed of riding camel trained for warfare and racing is known as the *mehari*. It can travel 75 to 120 miles a day at a steady trot of 9 to 10 miles an hour. In older times, a thoroughbred riding camel was called a *dromedary*, but now we use the word to mean any camel with one hump. The word comes from the Greek *dromas*, meaning "running."

To ride a camel, a man needs the courage and hardiness of a sailor. After he climbs on its back and gives the command to rise, the animal heaves its big body up with a groan, then starts to walk, or rather to rock. This motion is due to the fact that it lifts both feet on one side at the same time, tilting its body from one side to the other. Tossing and pitching, the rider feels as though he were in a sailboat on choppy water. So violent is the motion that the camel police of Egypt bind their bodies tightly with long strips of cloth when they ride over the desert chasing lawbreakers. Motor trucks have replaced baggage camels to some extent, but the riding camel is still an important cavalry animal in desert military operations.

Two Kinds of Camels

There are two kinds of camels. The Arabian, or single-humped, camel is found in northern Africa, Arabia, and western Asia. The Bactrian camel with two humps is found throughout Asia.

The Bactrian camel has reddish-brown or black hair. Its body is much shorter, thicker, and heavier than the Arabian's. Its feet are more calloused and

What SINBAD FOUND OUT *in the* DESERT

The Story of a Young Camel

"I want to go out on the desert," said young Sinbad

SINBAD was a baby camel He lived with his mother in the far-off land of Arabia, away across the sea Arabia is very hot and dry There are deserts there where the yellow sand stretches away for miles and miles It was at the edge of one of these deserts that little Sinbad lived

He was only a few weeks old, but he had already learned to walk on his long thin legs At first they were so wobbly that he could scarcely stand up on them at all, but now although they still felt a little queer, he could walk about without once falling down This made him very proud

This morning little Sinbad stood in the sand looking contentedly off across the desert The hot sun beat down on him but he did not mind He liked the sun, and he liked the sand so he was very happy

Not far away from him knelt his mother, blinking her eyes sleepily as she chewed her cud She had a long neck, a small head, and a big body covered with shaggy brown hair On her back was a great hump Little Sinbad thought she was a wonderful creature

"Mother," he said to her, 'will I ever be as big as you are?"

"Of course you will," she told him "You are a fine young camel and you are growing very fast "

"I'm glad,' he said happily "I want to be big for then I can walk out there on the sand that stretches away so far, and I will see what the desert is like

The mother camel looked at him for a moment working her lower jaw from side to side as she chewed 'Yes " she said, I suppose you will want to get out on the desert as soon as you are old enough But you will not find much out there to see In the desert there is nothing green—only sand and rocks and a few prickly shrubs "

"But I want to see it anyhow, Sinbad said "I want to go out on the desert '

'You will," his mother said 'You will cross the desert many times when you are older and carry loads on your back for our master Sometimes our master himself will ride on your back There he comes now " she added "He is bringing me my breakfast

Sinbad saw a man come out of a tent, carrying an armful of fodder He was a tall man with a brown skin Instead of a hat he wore a bright red and white striped turban wound about his head

The little camel moved nearer to his mother "Our master brings you your breakfast every morning, doesn t he?' he asked "He is a kind master "

'Yes " answered his mother, 'he is kind, but he only feeds me so that I will be strong enough to work for him Our master could not get along without his camels to carry burdens for him across the desert There is no other creature that can travel in the desert the way we can We have soft pads on the

bottoms of our feet that spread out wide and flat when we walk and keep our feet from sinking in the deep sand. We can go without food and water, *too*, if we have to. And we often *do* have to, out there in the desert where no green thing grows, and where there are no streams of water."

"But what do you do when you get hungry and thirsty, mother?" little Sinbad asked.

"We are well fed and watered before we start on a journey," his mother told him, "so we do not get hungry or thirsty very soon. We can live for a while on the fat in our big humps, and we can store enough water in our stomachs to last for days and days."

"We are wonderful creatures, aren't we?" little Sinbad said.

"We are very wonderful creatures," his mother answered. "You should be proud that you are a camel."

She got slowly up, lifting herself first on her hind feet and then on her front feet, as camels always do. Now little Sinbad could see the big leathery pads that grew on his mother's knees and chest. He would have pads like that, too, he knew, when he was a little older. All camels have them so that they can rest softly when they kneel on the ground.

He stood beside his mother while she ate her breakfast. When she had finished, her master made her kneel down and put a strange looking saddle across her back. At once she began to groan so loudly that little Sinbad was frightened.

"No—o—o——o—o—o!" she groaned. "No—o—o——o—o—o!"

"Does the saddle hurt you, mother?" Sinbad asked

"No," she answered, "it does not hurt at all, but I groan just the same. You must always groan when our master puts anything on your back. *No* matter whether it is light or heavy, you must groan as loudly as you can."

"What for?" little Sinbad asked in surprise.

"It is the way we camels do," she answered. "Perhaps if we did not, our masters would put loads on our backs that are too heavy to carry—I do not know. But I *do* know that we always groan. You must remember this when you are old enough to travel."

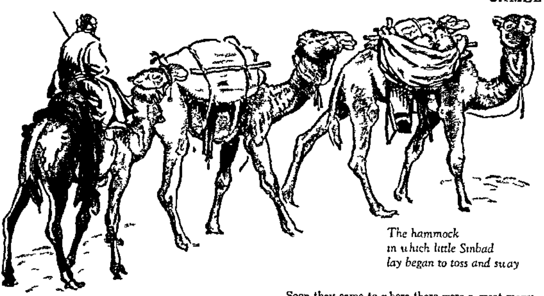
"I will," little Sinbad promised. "I will groan with all my might. But mother, why has our master put that big saddle on your back? Do you know why?"

"I suppose we are going to make a journey," his mother told him. "A journey out into the desert."

"Oh!" cried little Sinbad happily. "Then I will walk far out on the sand, as I have always wanted to!"

"No, Sinbad," she answered. "You are too young to walk far. You will have to be carried. Baby camels always have to be carried when they make a long journey."

She was about to say something more, but just then their master led up one of his biggest camels and made it kneel down. Across his back he put a saddle and on each side of this he fastened a heavy load.



The hammock in which little Sinbad lay began to toss and sway

When he had finished doing this he picked little Sinbad up in his arms and put him into a sort of hammock that swung from one side of the big camel's saddle.

Sinbad was surprised and frightened. He kicked and squirmed as hard as he could, but his mother called to him and tried to quiet him.

"Be still, Sinbad!" she said. "They are not going to hurt you. You will ride in your hammock and I will walk just behind you. All baby camels ride like that."

"But I'd rather ride on *your* back, mother," little Sinbad cried. "Why can't I?"

"Because I must have you where I can see you all the time," she told him. "Be still now and you will be all right."

So Sinbad lay still in his hammock while their master fastened a great load on his mother's back.

"Maybe this will be fun after all," he thought, now that he knew his mother would be close to him. "I will see the desert that I have wondered so much about."

"*Goom!*" their master cried suddenly. "*Goom!*" This was his way of saying "Get up!"

Sinbad's mother and the big camel got slowly to their feet, groaning and grumbling. The hammock in which little Sinbad lay began to toss and sway, for a camel has a very queer way of walking. It moves the two feet on one side of its body at the same time and then the two feet on the other side of its body at the same time, so that its body rolls from side to side. But little Sinbad did not mind this; he liked the motion.

Soon they came to where there were a great many other camels with loads upon their backs. They were being formed in a long line, one camel behind another. Sinbad's big camel took his place in the line and Sinbad's mother followed close behind.

It was all very new and strange and exciting. It was exciting to see the desert, like a great ocean of sand, all round him, and to watch his mother plodding patiently along behind him, holding her head high and looking at him all the time with her big soft eyes. And it was exciting to hear the tinkling of the little silver bells that many of the camels wore.

For a long time they traveled on under the hot sun. When noon came the caravan stopped for a rest. Sinbad's master lifted him down from his hammock. The little camel ran quickly to his mother and greedily drank the milk that he was so hungry for.

When he had finished he walked about for a while. It was wonderful, he thought, to be out on the desert like this! He would have liked to walk on and on, but his mother was kneeling down and he did not dare to get far away from her.

The other camels were kneeling, too, resting quietly until the time came to start on again. Most of them had crossed the desert many times before and such a journey as this was nothing new to them. But to little Sinbad it was very strange.

He looked curiously at the camel drivers sitting about on the sand and talking to each other. When would they be ready to go on across the desert, he wondered.

Suddenly he saw some of them spring to their feet. Then others jumped up, and still others, until all of them were running about, calling excitedly to each

other. The camels were excited, too, and the men were very careful not to get too close to them. For no one can tell when a camel may lose its temper and begin to kick and bite anyone that happens to be near it.

Little Sinbad raised his head and listened. He heard a low roaring sound that rolled across the desert, growing louder every minute. "The wind! The wind!" he heard an old camel say. "The wind is coming!"

Sinbad had heard the wind blow before, but he had never heard it roar like this! He ran as fast as he could to his mother's side. "What is it?" he cried. "What is it, mother?"

"A sand storm is coming," she told him. "You must lie down here beside me, Sinbad. Stretch your head flat on the ground! See how the other camels are doing!"

Little Sinbad at once did as he was told, for something in his mother's voice frightened him. "What is a sand storm, mother? Will it hurt me?" he asked.

"Not if you do as I tell you," she answered. "You must close your eyes. Your long eyelashes will help keep the sand out of them. And you must close your nostrils tight so that the sand will not get into your nose. Then you must lie as still as you can lie."

The hot wind came with a mighty rush and roar, and the sand beat against Sinbad's body like sharp little needles. He closed his eyes and he closed his nostrils as tight as he could; and he waited.

The camel drivers huddled behind the kneeling camels for protection. The camels lay very still, their heads flat on the ground, their eyes and nostrils closed, while great clouds of sand came sweeping in across the desert.

It seemed a very long time to little Sinbad that he lay there, trembling with fright. After a while the storm died down and the wind stopped roaring. Then he heard his mother's voice again.

"The storm is over, Sinbad," she told him. "You can open your eyes now. You have been brave."

"Have I, mother?"

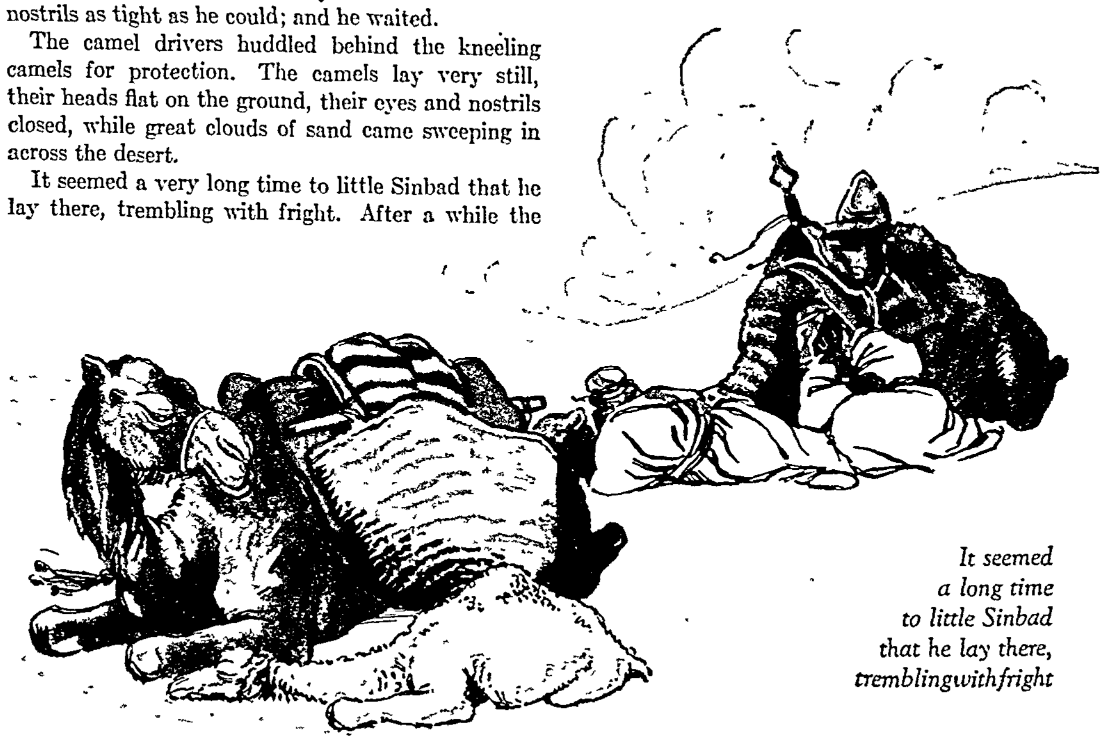
"Yes," his mother said. "Not many little camels as young as you are have gone through a sand storm like this. You did it exactly right."

"The camel drivers had to hide behind their camels to get away from the storm, didn't they, mother?" little Sinbad said.

"Yes," his mother answered, touching him with her queer soft upper lip; "but we camels didn't have to hide. It is better to be a camel than anything else when a sand storm comes. We camels belong to the desert and it belongs to us. You have good reason to be proud, little Sinbad."

The little camel thought about this for a long time. He was still thinking about it when the camels moved off again on their journey. High up in his little hammock, he looked across the desert, that stretched on and on as far as he could see. He was happier than he had ever been before.

As the camels swayed along on their way, little Sinbad thought: "I am glad that I am a camel. I am glad that I belong to the desert. I would rather be a camel than anything else in the world!"



It seemed a long time to little Sinbad that he lay there, trembling with fright

better able to stand rocks, snow, and ice It can *drink salt water and swim for short distances* The hair in winter may be a foot long The camel's hair cloth we use in fine overcoats and other clothing comes from the Bactrian camels of Mongolia and northern China *The finest quality is the short silky down*, next to the skin

Scientists tell us that the first camels lived in North America millions of years ago, and many fossils have been found They show a steady development from tiny creatures no larger than rabbits to the great beasts we know today *At* some distant time one group migrated to Asia across a land bridge that once existed over the Bering Strait Another group smaller and without humps, went into South America The llamas, alpacas, and vicuñas are the descendants of this second group Thereafter, camels died out in North America

There are no records of wild camels, so the desert dwellers of Arabia must have domesticated the camel in prehistoric times In the Bible we read that Abraham took on his journey sheep and oxen and camels ' Job had at one time 6,000, and the Amalekites possessed "*camels without number as the sands by the* seashore for multitude '

About 1857 the United States Army tried to introduce the camel into the deserts of Arizona and New Mexico, but with little success Descendants of these camels were seen as late as 1920 Scientific name of *Arabian camel, Camelus dromedarius* of the Bactrian camel, *Camelus bactrianus*

CAMELLIA. Everyone will acknowledge that the camellia, or 'rose of Japan ' is one of the loveliest flowers ever introduced into this country, but unlike the European rose, which it resembles, it has little fragrance *The camellia plant is an evergreen shrub* or tree with thick dark shining leaves, and in its wild state has red flowers like those of our wild rose Most of the cultivated forms are double or triple and vary in color from yellow and white to pink and deep red The camellia is a native of China, India, and Japan, and was introduced to Europe in the 17th century by a Jesuit, George Joseph Kamel, from whose name the latinized word camellia is derived It is now extensively cultivated in greenhouses in Europe and the United States, and in some places in the South the bushes grow luxuriantly in the open ground

The camellia belongs to the tea family *Theaceae* and its closest relative is the common tea plant. There are about ten species all belonging to one genus *Camellia*. The seeds of some species are rich in oil which forms an article of commerce in the Orient.

CAMEO. An engraved gem or sea shell bearing a design cut in relief is called a *cameo*, as distinguished from an *intaglio*, in which the engraved object is hollowed below the surface Cameos are most frequently made from gems composed of two or more layers of different colors The figures are cut in relief upon one of the upper layers of color, and the under layers form the background The stones most used are agates, onyx, sardonyx, and chalcedony Cameos have been used not only for personal jewelry but for adorning cups, vases, and even furniture A great number of cameos of the Egyptians, Greeks, and Romans are preserved in museums

CAMERA If you darken a room on a bright day and admit no light except through a very small hole in the window shutter, an inverted picture of the objects in front of the hole will be formed on the back wall of the room, or on a white screen placed nearer the window This is the simplest form of the *camera obscura* which in Latin means dark chamber', it was used several centuries ago for observing eclipses A smaller camera obscura may be made by constructing a small box, with a pin hole in one side

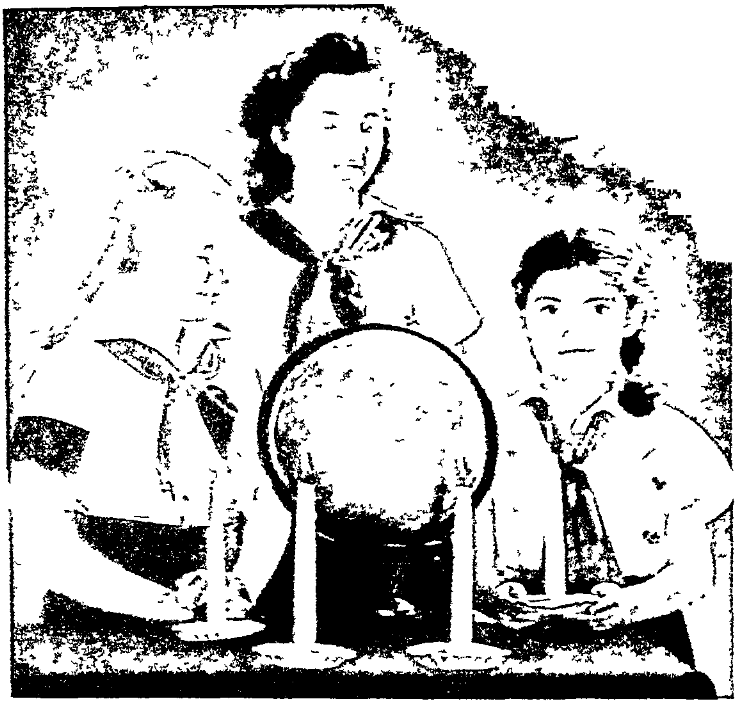
If a lens be put in the aperture, a much clearer and sharper image will be formed If this image is allowed to fall on a plate or film covered with chemicals sensitive to the action of light, and the plate or film is properly developed and 'fixed' by other chemicals, a permanent picture is obtained, and the camera obscura becomes a photographic camera (*see* Photography, Motion Pictures) The image is *more or less distinct according to its distance from the* lens, and so it is necessary for fine work to focus the lens by moving it nearer to or farther from the back wall of the camera This is done by making the sides of folding leather, and such cameras are called "bellows cameras"

If a mirror is put at an angle of 45 degrees inside a camera obscura, an image of the objects before the lens will be formed right side up, on a piece of ground glass above the mirror The viewfinder, with which many photographic cameras are provided, is just a small camera obscura of this sort The periscope is a camera obscura arranged to reflect downward (*see* Lens, Periscope)

The *camera lucida*, a simple reflecting device, when placed before the eye, projects an image of the subject on drawing paper, where it may be copied accurately Formerly much used in microscopic work, it has been supplanted by modern photographic methods It is still used by artists and draftsmen.

CAMOUFLAGE Disguising objects to deceive the enemy goes back at least to the Trojan Horse In the first World War, it became an organized science called camouflage Ships and land targets were screened from enemy observation with designs resembling those that conceal animals from their foes (*see* Protective Coloration) Coverings of branches or fabrics and confusing patterns of paint were used for this purpose They succeeded quite well in deceiving the camera and the human eye. But in the second World War photographic filters revealed camouflage by picking out artificially colored objects from their natural setting This forced the use of more elaborate methods For example, the wide flat roof of an airplane factory might be made to appear like a farm by covering it with soil and actual farm buildings

AT WORK *and* PLAY *with the* CAMP FIRE GIRLS



The three girls shown here are taking part in a world friendship candle-lighting ceremony. Learning to be good citizens of the world through friendship with young people in other lands is part of the Camp Fire Girls' program.

CAMP FIRE GIRLS. Working together and playing together mean fun and accomplishment to almost half a million Camp Fire Girls in the United States and other countries. After school and during vacations these girls meet together in small neighborhood groups for leisure-time activities both outdoors and in.

The story of Camp Fire begins in the woods of Maine, where a family went camping each summer. Mother, father, and the children shared alike in work and play. Even dull chores were fun, because they gave every one a part in making the camp a success. And plenty of time remained for music, games, and stories.

The parents who made so much fun out of camping were Dr. and Mrs. Luther Halsey Gulick. They believed that other girls would enjoy working and playing together, not only during vacations but in the hours after school. So, with the help of other leaders, they drew up a year-round program of activities for young girls. In 1910 they founded a national organization called Camp Fire Girls to carry out this program. Since then more than 2,000,000 girls have joined Camp Fire. There are now more than 360,000 members in the United States alone. Great Britain, El Salvador, and the Republic of the Philippines also have Camp Fire organizations.

Girls from 7 to 18 years old, of all races and religions, belong to Camp Fire. There are three age groups. Blue Birds, the juniors, are 7 to 10 years old. Camp Fire Girls are 10 to 15. Horizon Club, the senior division, includes girls from 15 to 18.

In both Blue Birds and Camp Fire Girls the unit of organization is a *group* of 6 to 20 girls. Each group has a member who is 18 or older. Blue Birds call this member their Leader. Camp Fire Girls call her their Guardian. Horizon Clubs have 10 to 20 girls and an Adviser, who is at least 21. All Camp Fire units have sponsors. These may be mothers or fathers of the girls or other interested grown people.

Each Camp Fire group in the United States gives itself an Indian name. "Wetomachick," meaning "friends," is an example. Members also take Indian names, such as "Wawingts," or "skillful," to represent their hopes of achievement. Camp Fire uses such names because it built much of its program on customs of the American Indians. Groups in other countries use symbols from their own national traditions.

CEREMONY OF THE COUNCIL FIRE

Above, a Torch Bearer stands ready to light the Council Fire. At this ceremony Camp Fire Girls receive ranks and honors and welcome new members. Council Fires may be held indoors, with candles taking the place of the traditional log fire. The girls here are all wearing ceremonial gowns and headbands of khaki trimmed with leather. Camp Fire Girls may get these when they are working for Fire Maker rank.

CAMP FIRE GIRLS HELP SANTA

These Camp Fire Girls are dressing dolls to be delivered at Christmas time to children of needy families in neighboring rural communities

Camp Fire Girls work for honors in seven crafts—home, creative arts outdoors scientific frontiers business, citizenship and sports and games Caring for a baby, baking a cake planting a garden and designing the settings for a play are a few of the hundreds of achievements for which girls can win recognition As they earn more and more honors they advance through four ranks—Trail Seeker Wood Gatherer, Fire Maker, and Torch Bearer

Blue Birds are not quite ready for the full Camp Fire program They have group parties and games and begin to develop skills in the seven crafts Horizon Club members on the other hand, carry on Camp Fire activities from a more grown-up point of view They emphasize development of personality and poise They work to acquire self confidence in meeting adult problems

All three divisions of Camp Fire join in a special national project each year Sometimes, as in a "Hi Neighbor" project the emphasis is on learning to appreciate one's neighbors of different racial national and religious backgrounds Sometimes the girls concentrate on activities that will help to strengthen family ties and enrich home life One purpose of Camp Fire, as stated in the constitution is "to perpetuate the spiritual ideals of the home"

Blue Birds, Camp Fire Girl groups and Horizon Clubs take part in many community projects They coöperate in clean up and safety campaigns, help raise money for the Community Fund and sew for the Red Cross and the Needlework Guild Girls who are old enough serve as hospital aides All enjoy international friendships by writing to "pen pals" in many parts of the world

Outdoor activities are as important today as they were in the days of the Gulicks Adventure hikes, cook-outs, canoe trips, and nature study provide many good times. Camp Fire owns hundreds of camp sites where the girls spend week ends during the school year and have longer outings during the summer

Camp Fire Girls always remember the Law of Camp Fire Worship God, Seek Beauty Give Service Pursue Knowledge, Be Trustworthy, Hold on to Health, Glorify Work, and Be Happy

In large communities Camp Fire has a local executive who helps groups organize arrange programs and settle problems There may be a local council of interested citizens who promote Camp Fire activities If there is no local executive or council National Headquarters of Camp Fire in New York City, helps local groups in all their activities

Camp Fire publishes several books to help the girls and their leaders These include 'The Blue Birds' Book', a leader's program guide 'The Book of the Camp Fire Girls' and The Horizon Club Program Book' They may be obtained from the New York headquarters Camp Fire publishes a monthly bulletin *The Camp Fire Girl* with suggestions for all groups National dues are 50 cents a year for Blue Birds and $1 for Camp Fire Girls and Horizon Club members

CAMPHOR Manufacturers soldiers doctors and housewives all use products made with the fragrant substance known as camphor About 66 per cent of all camphor used in the United States goes into the manufacture of plastics Ten per cent goes into smokeless powder and ten per cent into drugs and ointments The remaining 14 per cent appears chiefly in moth cakes and other insect killers furniture polish and nail polish

Natural camphor comes from a stately laurel tree *Cinnamomum camphora* Wood from the tree is cut into chips and these are steamed Camphor comes off as vapor The vapor condenses into crystals and oil Heating the crystals with charcoal and quicklime produces a vapor which condenses into gum camphor

The camphor laurel is a native of Formosa People in other lands have not been able to grow it successfully for camphor production From 1895 to 1945 Japan controlled Formosa and with it the world's supply of natural camphor

Chemists began trying to make artificial (synthetic) camphor about 1900 By 1928 Germany was exporting large amounts The United States began commercial production on a large scale in 1933 and now produces most of the camphor the country needs

The raw materials of synthetic camphor are turpentine and hydrogen chloride gas Refining crude turpentine by a special process produces *pinene* To make camphor, pinene is sent through a series of pipes and tanks to be blended with the gas at various heats and pressures The product emerges as camphor flakes

Camphor is a white, crystalline, gumlike solid with the formula $C_{10}H_{16}O$ It is inflammable and volatile In insecticides, camphor gives off an injurious vapor while evaporating In pyroxylin plastics it serves as a *plasticizer* (*see* Plastics) In smokeless powder it acts as a *stabilizer*, slowing down deterioration of the explosive Camphor's use in medicine is as a *counterirritant* in lotions and nose drops

The WHERE, WHAT, *and* HOW *of* CAMPING

"There's a good place," shouts the leader. The boats put in to shore. The tents go up. Soon the fire will be blazing for the evening meal, and the young campers will add a thrilling new chapter to their book of "adventure in the wilderness."

CAMPING. The thrill of a camping trip is one of the keenest pleasures within our reach today But it is a pleasure which is reserved for those who are willing to learn the simple rules that make camp life comfortable and free from trouble.

Each year sees a growing number of boys, girls, and adults finding rest, relaxation, and fun in our woods, and on our lakes, rivers, deserts, and mountains. In the vast stretches of the United States, Canada, and Mexico there are still regions where the experienced camper can find a wilderness almost equal to that faced by his pioneer ancestors. But a trip to those remote regions is not necessary. Wherever you live, there are sure to be places near at hand where you can enjoy camp life with sufficient independence and privacy to make it interesting, without the risk or expense of venturing far from civilization. Many such places have been set aside especially for campers.

Planning Your Camping Trip

Information about districts suitable for camping can be obtained locally from chambers of commerce, automobile clubs, highway departments, county or state park commissions, and conservation bureaus; also from stores that sell camping equipment. The excellent "Recreational Map" issued by the National Park Service in Washington, D. C., is also a splendid source of information.

The type of country in which you intend to camp, the season of the year, and your own facilities will largely determine the nature of your trip—whether you go on foot, by canoe or boat, or on horseback. You may often be able to enter the camping district of your choice by automobile or bus, but the most desirable camp sites are usually some distance from the main highways. In some of the national and state parks bicycle trails lead to the camp grounds.

But whatever the nature of the trip, its success will depend upon preparedness. Even those who go camping within five miles of their home must know the tricks that make life in the open easy and comfortable.

Need for Leadership

No camping should ever be undertaken without suitable leadership. By "suitable" is meant a mature person, with good judgment, who likes boys and girls and camp life and knows the out-of-doors thoroughly from actual experience in it. Emergencies may arise on even the simplest camping trip which will demand the judgment and counsel of one more experienced than the young novice. Being a member of a camping party is like being a member of a team, and there must always be a captain to help in making plans before and during the trip, in keeping up the spirit of coöperation and good will, and in taking the responsibility for the health, comfort, and safety of the group. Accidents and even fatalities happen, especially in and on the water, usually on account of ignorance and carelessness, and that is one reason why this older leader is so necessary to keep things going smoothly and safely so that the fun and adventure of the trip will not be marred by unnecessary mishaps.

Finding a Good Camp Ground

Next in importance to the choosing of the leader comes the question of choosing the camp site. If you plan to stay in one place, it is often possible to scout around before the trip starts and locate an ideal spot. But when you intend to move about through strange

country you must trust to luck that by four or half past four in the afternoon a good camp site will appear A large-scale topographic map of the locality will help to indicate likely spots

The first three essentials of a camp site are good drinking water plenty of fuel and dry ground A smooth place with a slight slope will let rain drain away Storms turn many an attractive spot into a temporary marsh because tl e ground forms a slight hollow

In the fall and winter choose a site that is sheltered by hills or trees against the prevailing winds Perhaps the air will be still in the afternoon when the tents are pitched but before morning a biting breeze may make an exposed camp seem like an explorer s station at the South Pole

During warm weather on the other hand the camp should get plenty of a r Tl e ideal spot is on a point or rise with trees for shade in the afternoon but with morning sun to warm the camp and dry up the dew In nearly every locality the fair winds blow from one direction the storms from an other Find out about this from the natives and try to have clumps of trees or a sheltering ridge on the stormy side of your camp

Do not pitch a tent near a dead tree which might blow down in a storm Do not set your camp near a cliff or the steep edge of a ravine over which someone may fall in the dark If you must camp near a cliff be sure to rig up a rope railing or lay a line of brush at least ten feet back from the edge Explore any waters in which you intend to bathe for quick sands submerged rocks with sharp edges and snags on sunken trees

Beware of camp sites near dry brush stands of dry grass or piles of dead leaves A flaming spark in this kind of material may turn into a raging and uncontrollable fire before you can run across your camp ground to put it out

Do not camp near growths of poison ivy poison sumac or ragweed And remember that mosquitoes lie in wait near swamps lush grass and stagnant water If you are close to a town or in a much used camping area avoid places where old tin cans broken glass rusty nails or decaying refuse may be lying around

Permission to camp on private land must always be obta ned from the owner and in many government areas a permit is required to use the camp sites light fires or cut dead timber The good camper not only leaves the site in better cond tion than when he found it but he also keeps it in excellent condition during its use by the simple expedient of having a place for everything and keeping everything in its place

Camp Equipment—Choice of Clothing

No set list of equipment will meet the needs of campers under all conditions Horace Kephart famous authority on camp lore gives us the key to the problem when he says Ideal outfitting is to have what we want when we want it and not to be both

IDEAL SPOT FOR A CAMP IN HOT WEATHER

The sleep ng and living quarte s stand high on a point whe e the breeze keeps them cool and d ves insec s away Down the s ope near the wate s edge a e the cooking quarters wi h a s mp e tarpaulin she te for supplies The tents shown he e a e of the umb el a type recommended by many experienced campers

ered with anything else His advice applies to all types of equ pment—shelter clothing cooking utensils tools and general camp supplies One never failing rule is to watch the natives see what they wear and how they camp out and then do likewise

Camp clothing should be chosen for warmth wear and water resistance Novices tend to wear warm weather outfits that are too thin and flimsy and cold weather outfits that are too heavy and bulky In summer underwear may be thin and of open texture if the outer garments are adequate to protect you against too much hot sun The exper enced camper takes sun baths in small doses He never starts out on a long hike or canoe trip on a sunny day with shoulders and knees bare He lets the other fellow get the heavy coat of tan and he knows that a painful sun burn is the mark of a greenhorn

In cold weather light wool underwear next to the skin will do more to keep you comfortable than a thick over coat and a single sweater covered with a th n windproof coat is warmer than two heavy sweaters without the coat

Light woolen ankle socks may be used around a camp site, but for general use thick wool golf socks or stockings are desirable. Town shoes with thin soles are worthless. Shoes should have strong soles, be roomy and comfortable, with low, broad heels, and sufficiently high to give protection to the ankles. Rubber soled "sneakers" may be worn for boating and canoeing but never for traveling overland. Lightweight woolen pajamas are best for northern climates and high altitudes, and the ordinary cotton pajamas for general use.

Here is a check list of personal equipment for a three-day trip:

For Each Camper	*Extra for the Leader*
2 sets underwear	First-aid kit
2 shirts or top garments	Watch and whistle
1 pair of pajamas	Pencil and notebook
1 pair of overalls knickers, bloomers, or breeches	Maps and compass
1 pair of shoes or boots and lighter pair to wear in camp	Food list, menus, recipes
2 pairs stockings	Reserve supply of matches
1 sweater or lumberjack	Ditty box (needles, thread, safety pins, elastic bands, buttons, twine, candle ends, etc.)
1 slicker and rain hat	Tools—pliers, flat file, claw hammer, assorted nails
1 bedroll or sleeping bag	Spool of 2-inch adhesive tape for mending paddles, patching leaks in canoes, tents, etc.
1 set of toilet articles	Money, in change and small bills
3 handkerchiefs and a bandanna	Field glasses
1 mess kit or equivalent	Camera
1 hatchet or one hand ax	Extra rope, paddles, etc.
1 jackknife	
1 flashlight	
1 waterproof match case	
1 swimming suit	
1 large piece of mosquito netting	

The leader may also bring bird and plant guides, and other books suited to the interests of the expedition.

Packing and Sleeping Equipment

For longer trips a waterproof knapsack is necessary. This may be purchased, or made and waterproofed at home. It should have carrying straps coming from a single point of suspension in the back, should have outside pockets, and be waterproof. A rubber-coated poncho or a waterproof canvas ground cloth is absolutely essential when sleeping on the ground. It should be at least 66 by 90 inches in size, so that it may be used over as well as under the bedding. Ponchos or ground cloths may be used for making a temporary shelter, in which case they should have three one-half-inch grommets (metal eyelets) in each side, through which ropes are fastened for pegging out.

Plenty of bedding is essential and the wise camper makes up his bedroll as a series of folding envelopes in order to have as much under him as over. This makes it necessary to crawl in from the top like a caterpillar, but it is well worth the effort.

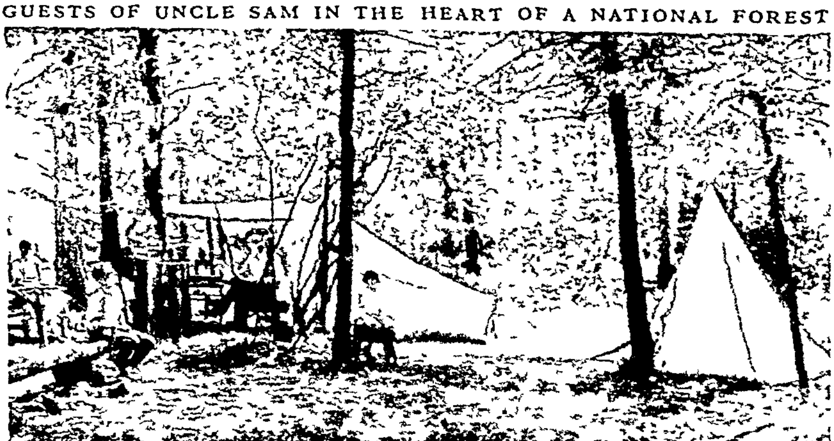
One all-wool blanket is worth two or three of the other kind. Furthermore, wool is warm even if it gets damp; whereas damp cotton is intolerable. See to it that you have plenty of bedding *under* you. Cold from the ground will reach you more quickly than cold from the air, and, unless your bed is on dry sand, you will find the ground nearly always cold. Layers of newspapers under the outdoor bed absorb the damp.

On longer trips, cotton ticks can be taken along and stuffed with straw, moss or dried leaves for a mattress. In planning a comfortable camp bed, do not be afraid of appearing "soft." The experienced camper knows that restless and uncomfortable nights can ruin an otherwise perfect trip.

Cooking and Eating Equipment

The best types of cooking and eating equipment are those consisting of a large kettle of cast aluminum inside of which all the other utensils are nested. These are sold by outfitting companies and the large mail-order houses. One or two smaller kettles fit inside the big one. Then comes the coffeepot with detachable handle, with the cups inside of it. Knives, forks, and spoons go into the free spaces. The plates fit in at the top, and a heavy straight-sided frying pan with detachable handle forms a lid over all. For short trips, however, equipment carefully selected from the 5- and 10-cent stores will suffice.

GUESTS OF UNCLE SAM IN THE HEART OF A NATIONAL FOREST



This camp in Idaho is pitched on one of the thousands of sites reserved for campers in the national parks and forests. The small tent at the right is of the "forest ranger" type, snug and light.

Long-handled mixing spoons (with hole in handle), water pails with covers, a long-handled fork, and a pair of cheap cotton gloves are all useful. Also useful, but not essential, are a reflector oven, sheet steel oven, grate or grid, and Dutch oven.

Screw-top or friction-top tins lined with waxed paper are good for packing bacon, butter, coffee pickles, etc. White paraf-

fined food bags in different sizes from one to ten pounds are best for packing all dried foods These bags and all other food containers are packed in a small duffle bag, pack sack, Adirondack pack basket, chuck box, or whatever is chosen to hold food supplies Food for trips should never be carried in glass containers

Tents and Other Conveniences

There are literally dozens of kinds of tents and shelters available The army pup tent is the most popular on short trips For longer trips when roomier and more secure shelter is desirable, the "umbrella" tent with sewed-in floor has proved to be one of the very best (*see* picture on a previous page of this article) It can be put up even faster than a pup tent, and it will stand up in winds that would blow down tents of almost any other shape Telescoping and folding metal poles are provided for these tents but when it would be inconvenient to carry them, they can be left at home A center pole and two cross poles can be cut quickly at almost any camp site

Other items to be considered are a folding candle lantern or homemade equivalent, trench shovel, small spade or large trowel, dish pan and steel wool or copper sponges for scrubbing the dishes, clothes line and clothespins

Homemade Equipment

Much excellent equipment of all kinds can be made by campers themselves at little or no expense Tents, shelters, tarps, and ground cloths can all be made and waterproofed at home Ladles bowls, candle holders, and makeshift lanterns can be cut out from small tins A reflector oven can be made out of a five-gallon oil tin by cutting it in two from corner to corner and inserting wires across the inside for the baking shelf.

Excellent kettles can be made from No 10 tins, which have been opened with a patent can opener to leave a smooth edge Two holes are punched on opposite sides of the rim for inserting a stout wire bail A pamphlet published for the Girl Scouts gives illustrations and directions for many of these useful gadgets, and the outfitting catalogs of both the Boy Scouts and the Girl Scouts show pictures of all sorts of camping equipment

Choosing and Using a Knife

To enjoy a camping trip properly, campers must have good food In order to cook this food, there must be a good fire To build a good fire, the camper must have proper tinder, kindling and fuel, and that is why it is so very important to know how to use and care for the knife and ax These tools are absolutely essential, but they are also very dangerous if used carelessly Hence there are certain rules which must be followed in using each

MAKING CAMP ON A CANOE TRIP

These canoeists are beaching their canoes and unloading their gear ready to pitch an overnight camp Canoe trips lead campers to matchless forest and water scenes that are sometimes impossible to reach by car or even on foot

A knife should be plain and solid with large and small blades of good steel, and with a strong spring It should fit well in your hand and have a smooth grip The blades should be kept clean and sharp, which means that they must be carefully wiped after use and must never be thrust into a hot fire

When cutting hold the knife in the palm of the hand with thumb doubled back over the other fingers —not against the back of the blade In straight whittling, cut away from you with a shallow, straight push and with the blade forming an angle of about 45° with the direction of the cut Use the same place on the blade on any given stroke If your hands are soft, pieces of adhesive tape should be put in advance on places where blisters might form Blisters are "bad medicine" Sheath knives should always be worn on a belt behind one hip—never in front where they may stab through the sheath and into your leg when you stoop over

Never carry an open knife
Don't lay it down on the ground, open or unopened
Don't carve bark, trees, furniture, public buildings, railings, posts, etc
Don't cut knots
Don't use a knife as a screw driver, crowbar, hammer, or can opener
Don't whittle toward yourself

Hatchets and Axes

Hatchets have short helves, or handles Axes have longer handles The cheaper models of both, with stained or softwood helves, heavy heads, and bad balance, are dangerous and almost worthless Double-bitted axes should never be carried on camping trips An excellent all-round camp ax is one made of good tool steel with a hickory helve about 24 inches long The camp hatchet should be of equally good quality and of medium weight —from about 22 to 28 ounces

RIGHT AND WRONG WAY TO SPLIT A STICK OF FIREWOOD

The safe and proper way to attack the stick is shown at the left. Notice that the stick is supported in a groove in the chopping log and that the ax strikes the stick over the point of support. If you use the method shown at the right, you not only run the risk of cutting your foot, but you also strike the stick in a way less likely to split it at the first blow.

The helve is held in place in the "eye" of the head by a metal or wooden wedge, and it is of the *greatest* importance that the helve be firmly fastened into this eye at all times. It is extremely dangerous to use a tool with a loose head. When not in use, the hatchet should be worn in a sheath on a belt, just behind the hip, with the blade pointing toward the back. An 8-inch flat file and pocket carborundum or oil stone will keep the blade sharp and clean. When the ax is not in use the blade should be in its sheath or sunk into the chopping block. Never leave it on the ground.

The Art of Chopping

Among the many skills known to the competent axman, these are of special use to the camper: cutting large and small logs in two, splitting kindling, sharpening stakes or tent pegs, trimming limbs from a branch or a felled tree, and actually felling a dead or undesirable tree. To chop a large, movable log in two, a "V" is made on one side, the log is turned and another "V" made on the opposite side, the two "V's" meeting. Strokes are alternated and at an angle of approximately 45° to the length of the log. The "V" should be a little over half as wide as the log is thick. If a small log is to be severed, it should be placed on a notched chopping block or large log with the point at which it is to be cut directly on the block, and the ax brought down on it at that point.

In splitting kindling, *never* hold up a stick lengthwise on a block in one hand and bring the ax down on top of the stick, near the exposed fingers and hand. One safe way is to hold one end of the stick at an upward angle in the left hand and, placing the other end of the stick on the far end of the block, to deliver a sharp blow at the point where the stick rests on the block. If the stick does not split all the way through, a quick twist of the ax in the split will usually complete the job unless the stick has a crooked or knotty grain. If the stick is thick, tough, or green, it should be placed on a crotch in the chopping block and the blow delivered in the middle of the stick, where it rests firmly in the hollow.

USING A HATCHET

The girl's left hand is well out of danger. This is much safer than holding the stick upright and striking the end.

Stakes are made by holding one end in one hand at a slant of about 45° to the block, where the other end is braced in a small crotch or against a knot. In trimming limbs from a log, it is best to start at the butt or larger end and chop toward the tip. Wood chopping is not only a science, but an art. Here are a few general rules:

1. Do nothing that will mar or destroy property.
2. Never chop until sure the arc of your swing is clear of twigs or branches.
3. Get a solid footing. Have feet parallel and braced well apart and as much out of line of direction of stroke as possible.
4. Never chop anything that is likely to slip or move while ax is in the air.
5. Never put a foot on the log to hold it down while chopping.
6. Avoid striking knots.
7. Never throw an ax at anything.
8. Never allow anyone to stand in front of, behind, or near you.
9. In using a hatchet, hold it firmly in one hand, with wrist stiff. In using an ax, the hand nearer the head of the ax slips up and down the handle as the ax rises and falls.
10. Remember that a carelessly used ax is just as dangerous as a carelessly used gun.

Choosing Wood for the Fire

Ability to build a good fire under *all* conditions is one of the essentials of a

good camper Fuel is the first consideration Although you can serve the cause of conservation by using down wood (wood lying on the ground) as much as possible any old log or branch will not serve the purpose The hard woods—particularly hickory oak ash beech birch and hard maple—are best for broiling baking frying and wherever coals are needed Tl e evergreens and such soft l ardwoods as poplar and sycamore are good for qu ck short fires Campers do not u e p tchy woods for fuel if they can help it because tl ey are smoky and sooty Green wood w ll burn best in fall or winter when the sap is out and green wood from h gh land burns better than tl e same sort from low land or along a river edge Dry weathered roots sound top p eces from piles of driftwood and sound knots from decayed trees are good fuel

If a live tree must be cut select one which is crooked stunted of an undesirable spec es or one in a group that needs to be thinned out to make room for better growth In other words select the *worst* tree available that will suit the purpose

Tinder is the material used to start the fire Any of the follow ng makes good tinder shredded b rch bark from down trees curls snipped carefully from live birches sl vers shavings or shaved clumps from fat pine or dry soft wood dry spl t twigs from dead branches t ghtly rolled clumps of dry grass dried p ne cones dr ed weed tops

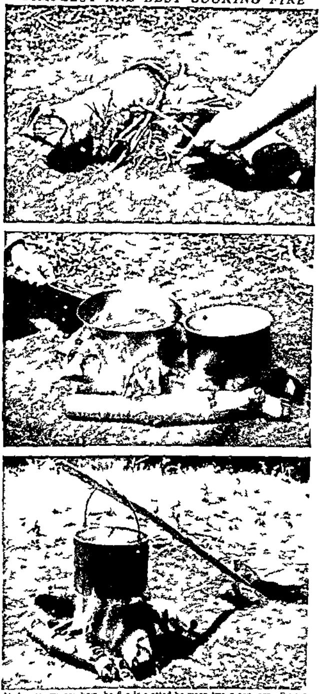
The tinder sets fire to the kindling wh ch in turn sets fire to the larger wood K n dling should be spl t into p eces small enough to catch fire quickly All three classes of fuel should be prepared for use and roughly arranged by s zes on the windward side of the fire s te If rainy the wood pile should be kept dry by a poncho tarp or rough shed of larger st cks

Types of Camp Fires

The following types of fires and their variat ons are the most common—the *hunter s* or *t apper s* fire the *trench* fire the *reflector* fire and the *log cabin* or *criss ross* fire The first three are useful for cook ng the th rd and fourth for warmtl and l ght The hunter s fire con sts of two wet or green logs at an angle or two rows of stones with tl e fuel la d between The w der end should face the wind The cooking utens ls are rested across the fire on top of the logs. An excellent variat on of th s fire is shown in the accompanying p ctures

The trench fire is rectangular in shape sl ghtly narrower than the pans to be rested across it and gradually sloped from the

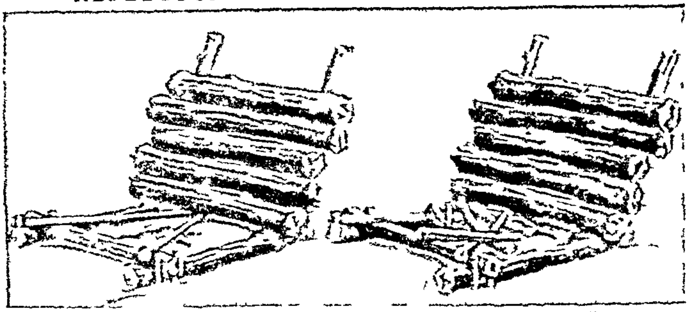
SIMPLEST AND BEST COOKING FIRE



At he op we see how he fi e is s arted be ween two g een ogs S on s can be u ed ns ead When the fi e has bu ned down a li tle we add a thi d green log on he open s de and se ou pans on the co ne s of he ang e as shown in the s ond p u e A he bo om we s e the same fire wi h a wonigan rig fo p olonged boiling in a ke tle

wider, windward end down to a foot or so in depth at the rear. The sod and dirt are placed to one side in a neat pile and when the fire is put out both are replaced so that little trace of the fire is visible. This type of fire is less likely to spread, conserves fuel, is not so hot to work over. The deep end of the trench may be lined with rocks and covered with a flat stone or old piece of sheet iron to make a sort of stove top. If the trench is made larger, we have the barbecue pit, bean hole, or *imu* pit.

REFLECTOR FIRE FOR WARMING A TENT



This kind of a "fireplace" six or eight feet in front of an open tent will warm the inside in a few minutes. The back and side logs must be green wood.

The reflector fire is so called because the heat is reflected from a windbreak and may be applied to a reflector oven or to heating a lean-to or open tent. The windbreak should be made as simply as possible of a large flat rock, the side of a boulder, or of an old piece of sheet iron or stove top. Failing these, it may be made by piling wet or green logs horizontally against two long stakes driven into the ground with a backward slant and supported by shorter brace poles

The log-cabin fire is made by crisscrossing green or wet logs to the desired height and then erecting a higher teepee of dry wood inside this pen The flame follows up this teepee and gives out light and warmth to the campfire circle.

Most campers, even those of wide experience, build far larger cooking fires than they need. The result is scorched food, burnt fingers, and smoke-filled eyes. A meal for six people can be cooked on a fire that you could cover with a Stetson hat. Get the fire going fast, let it burn down until the flames are low, bank it in close with the side logs, and then let your kettles and frying pan cover it almost completely to conserve the heat. There is an old Indian saying: "Red Man make small fire, sit close. White Man make big fire, stand far away." For cooking, it pays to try the Red Man's way.

There are many devices to hold kettles over a cooking fire. One is the *lug pole,* which consists of two crotched or split green sticks driven into the ground with a green pole across to hold the kettles. Another is the *dingle, wonigan stick,* or *tea stick,* which looks like a miniature well sweep (*see* picture on page 61).

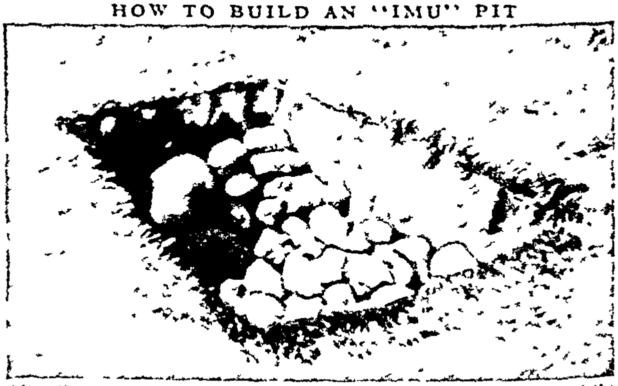
To get a fire started on a wet day, break off dead twigs from standing trees, make a large handful of fine shavings from them, collect thin peelings of birch bark, or shred some pine cones. Then split a few sticks into pieces no bigger than a pencil and pile them on your tinder in the shelter of a stone or log Set fire to this, and then put on two or three larger sticks As the flame rises, blow on it from the side—gently at first, then with increasingly strong puffs In a short time you will have a blaze hot enough to stand the addition of large wet sticks.

How to Put Out the Fire

Even more important than knowing how to build a fire is knowing how to put it out properly The public is constantly being educated to the dangers and terrible losses resulting from forest fires, for many of which careless campers have been responsible Every camper must consider himself a volunteer fire warden and help to educate other campers to the absolute necessity of making sure, first, that camp fires are built only in safe places, and, second, that every last spark or smolder of the fire is extinguished before leaving it, even if you are going to be gone only a short time.

The only safe way to extinguish fire is to throw on quantities of water, stirring up the ashes and underpart until all the sparks are out. If water is not available, the fire has to be beaten out and completely covered with sand or earth. In many places the ground is covered with a thick layer of pine needles, leaf mold, peat, or dry sod in which fire continues to smolder, even when it appears to have been extinguished on the surface. For this reason, always dig around the edges of the camp fire before assuming that it has been entirely put out.

HOW TO BUILD AN "IMU" PIT



After the stones have been heated for an hour or more, scrape out the coals, put in the fish or fowl wrapped in leaves or clay, put back the coals, and cover with earth for three hours. This is a Hawaiian trick

Camp Sanitation

There is no way to tell whether water is safe to drink short of having it tested in a laboratory. Running water does not purify itself. The clear spring

may harbor typhoid germs Unless the water supply can be taken from home or obtained at a nearby farmhouse where the supply has been recently tested and approved it will be necessary to purify the water on the spot Here are three ways to purify water out on the trail

1 Bo l for 15 m nutes and pour from one clean vessel to another to aerate
2 *Add Halazone tablets following directions on the bottle*
3 *Add 2 drops of 3½ per cent solut on of iodine to a quart of water and let stand twenty min utes before drinking*

The simple trench latrine is an acceptable way of disposing of human wastes After each use dirt is thrown back into the trench Garbage sho ild be buried im mediately in a garbage pit *Tin cans should* be put into the fire then flattened out and buried as should all glass and other such wastes Dish water should be poured careful ly in a spot where it will be absorbed quick *ly or else put in a rough stone-lined grease* trap or pit which can be burned out from time to time and ultimately covered Dish es should be washed in *hot* water with lots of soap and carefully rinsed in boiling *water and dried Sand moss grass roots and* paper napkins or towels are useful in cleaning st cky or greasy dishes The utmost care and cleanliness in the preparation preservation and consumpt on of food should always be observed

A HANDY PLACE TO WASH

Fa better than stoop ng over a basin on the ground is this G l Scout a rangement Notice how the washstand is made of s akes and slender branches tied together

Personal Health

No camper should start off on a trip unless in per fect health and unless through practise *walks or re*cent conditioning' events he is in trim for the demands the trip will make on his energy and strength Maintenance of the usual health habits and plenty of sleep and rest are part of the game A trip is a leisure*ly* excursion not an *endurance contest or a race* against time or the elements The wise camper must know how to protect himself from insect pests and po sonous th ngs of the woods He should be able to recognize po son ivy poison sumac and poison oak

If there are poisonous snakes in the locality the first-aid equipment should include a Dudley kit or a similar kit using *the suction cup treat*ment The e may be pur chased at drug and *sporting goods stores* Take care of every cut or bl *ster to avoid any* possible infection If you get a puncture wound from a rusty nail or a barbwire fence be sure to go immediately *to a* doctor for treatment (*See also* First Aid)

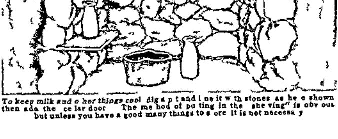
Safety Suggestions

Rules for water safety must always be fool proof Never swim alone *or when tired or over*heated Swimming in strange waters is ex tremely hazardous and it should never be done until the bottom and adjacent surroundings are investigated carefully and unless the leader is present *It is dangerous to go out in old rafts boats or canoes* found along shore Be careful not to overload boats of any kind and refuse to enter any boat with a per son who thinks horseplay on tl e ater is funny Nonswimmers should wear life preservers while they *are in boats or canoes If a boat or canoe upsets do* not try to swim ashore even if you are a good swim mer Stick to the craft until help comes or the boat can be pushed ashore For safety on land the campers should keep together especially in heavily wooded or hilly country Never eat or taste unfamiliar things, handle wild animals or cut across pastures or cattle *enclosures*

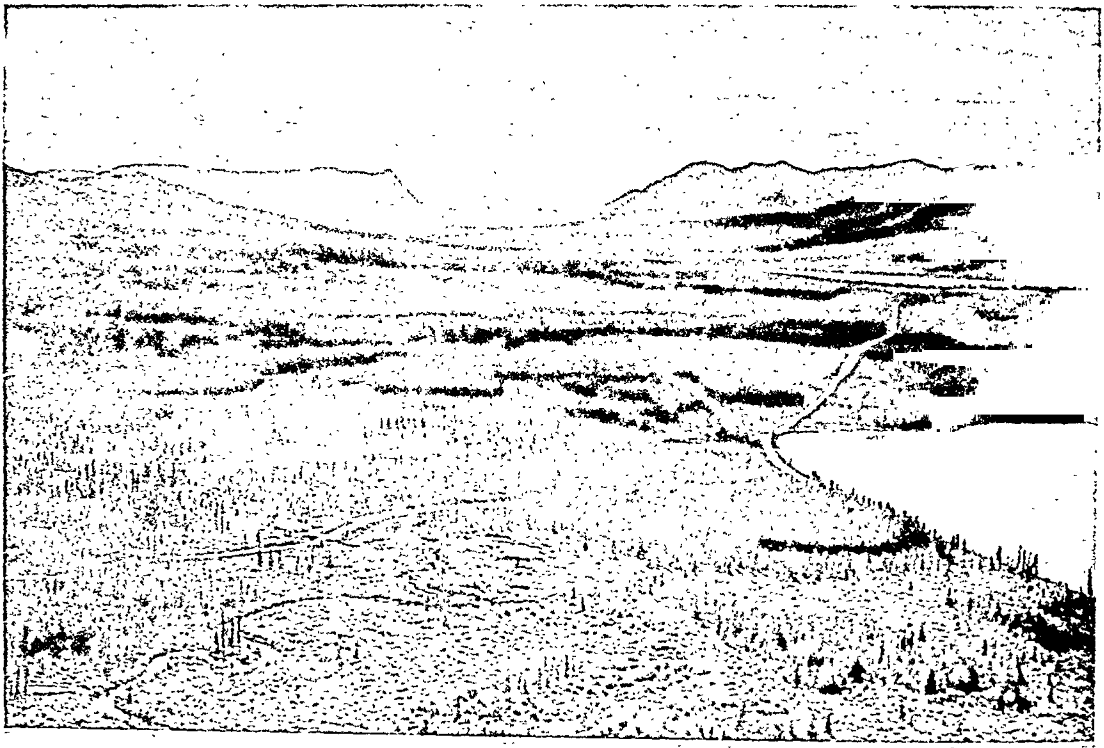
When campers have to hike along main traveled roads they should go in single file on the left side of the road facing the oncoming traffic ith the leader in advance of the group and an ass stant bringing up the rear At night the same forma t on *should be kept The leader and* assistant should each carry a light and wear a broad white band around the waist in add t on to the white handkerchiefs or bands which all the campers should wear tied on the ankles just above the shoe tops

(For further information on topics related to camping consult the art cle on Vacat on Activities For a cho ce of books see the Camping section in the b bl ography under Hobbies)

A CONVENIENT CAMP CELLAR



To keep milk and o her things cool dig a p t and l ne it w th stones as he e shown then add the ce lar door The me hod of pu ting in the she ving" is obv ous but unless you have a good many things to s ore it is not necessa y



Above, the Alaska Highway (formerly Alcan) winds across the lonely, empty wastes of the far Northwest. Through forests and over swampy muskeg, it twists toward the distant mountains. Far different is the scene below near Brampton, Ontario, with its cultivated fields, its greenhouses, and many farms, telling of a prosperous and long-settled population.

CANADA, *the* LAND *of the* MAPLE LEAF

Montreal Is Canada s Second Largest City and One of the Largest Inland Seaports in the World

CANADA From the northern border of the United States to the silent wastes of the North Pole from the Atlantic Ocean to the Pacific stretches the vast majestic land of Canada With an area of 3 845 774 square miles it is the third largest country in the world Only Russia and China have a greater area It is larger than the United States and Alaska combined and almost as large as all of Europe This sovereign nation in the British Commonwealth of Nations is 70 times larger than England Yet in all its great expanse live fewer people (14 009 429) than in the state of New York Like the beads of a necklace on a slender chain most of the cities and villages lie along the southern border Within 200 miles of this border live nine tenths of the Canadian people But the world significance of Canada and particularly its significance to the United States is far greater than its few people would indicate This is the only one of the 22 nations in the Western Hemisphere that has kept its political ties with Europe In the words of Winston Churchill British statesman it is thus a binder together of the English speaking peoples a magnet exercising a double attraction drawing both Great Britain and the United States towards herself and thus drawing them closer to each other

No geographic social or racial barriers separate Canada from its closest neighbor The two countries speak common language share a common historical background and way of life Even the large French-speaking group which comprises a third of Canada s population has far closer ties with the United States than with France from which it has been separated for nearly 200 years

Extent Area of Canada 3 845 774 square miles Extent east and west about 3 350 miles north and south excluding Arctic archipelago) about 1,600 miles Most northerly point Cape Columbia (in Grant Land) 475 miles from the pole Most southerly mainland point Point Pelee on Lake Erie 50 miles southeast of Detroit *Population (1951 census) 14,009 429*

Rivers and Lakes—St Lawrence Ottawa Nelson Churchill Red, Saskatchewan Athabaska Peace Mackenzie, Slave Yukon, and Fraser rivers Largest lakes excluding the Great Lakes) Great Bear Great Slave Winnipeg Athabaska Reindeer Winnipegosis Manitoba Nipigon Lake of the Woods

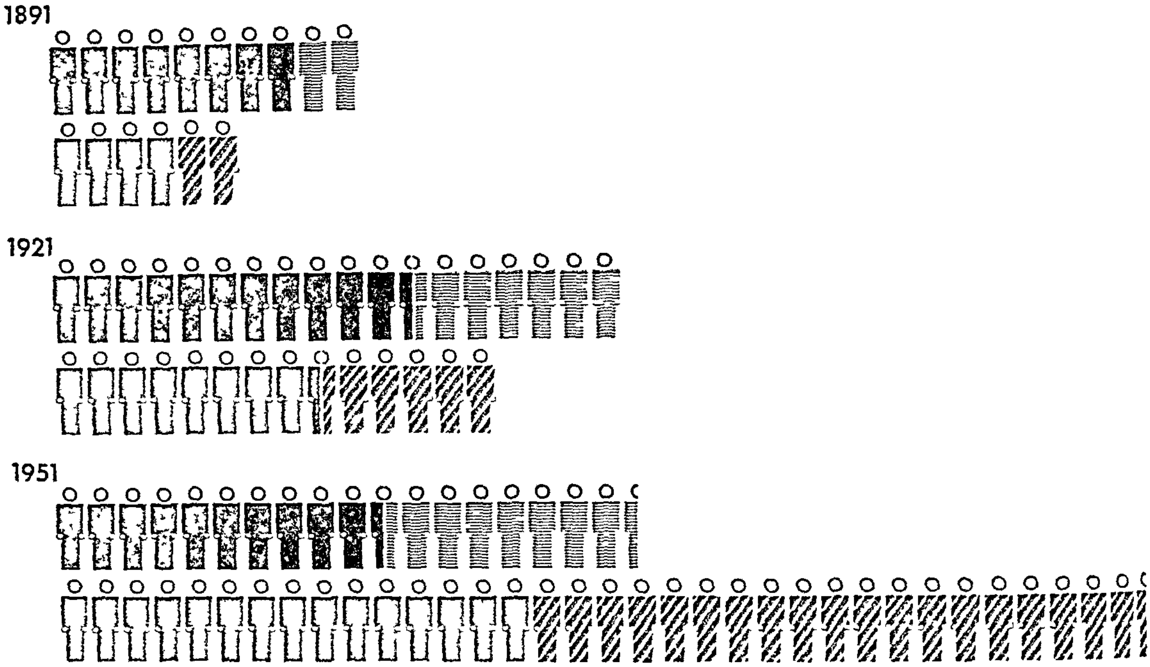
Mountains—Coast Range Rocky Mountains Selkirk Mountains Cariboo Mountains on Pacific coast Laurentians in Quebec Appalachians on east coast. Highest peak Mt Logan (19 850 feet

Chief Products—*Wheat oats barley hay flax* potatoes *orchard* fruits live stock and dairy products lumber pulpwood newsprint *textiles agricultural imp*ements, aluminum, *iron* and steel *chemi*cals, shoes, salmon cod lobsters herring and other fish coal gold nickel lead copper silver cobalt zinc asbestos platinum radium uranium titanium petroleum iron furs

Provinces—*Maritime Nova Scotia New Brunswick Prince Edward* Island eastern Quebec, Ontario Newfoundland western Mani*toba Saskatchewan Alberta British Columbia Territories* Yukon Territory Northwest Territories (Provisional Districts of Mackenzie Franklin, and Keewatin)

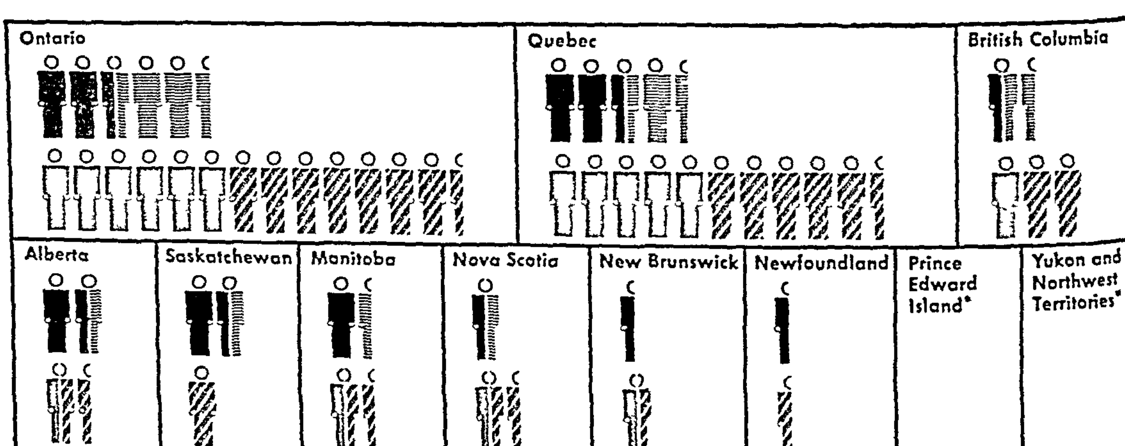
Chief Cities Toronto (1951 census 675 754 after 1953 federation with suburbs *1,117 470* Montreal *(1,021 520)* Vancouver Winnipeg Hamilton Quebec Ottawa (capital) Windsor Edmonton *Calgary (over 100,000* London *Halifax Regina* Verdun Saskatoon St John s Victoria Saint John (over 50 000)

How People Made a Living in Canada 1891-1951



Each complete symbol represents 100,000 gainfully occupied

Occupations by Provinces in 1951

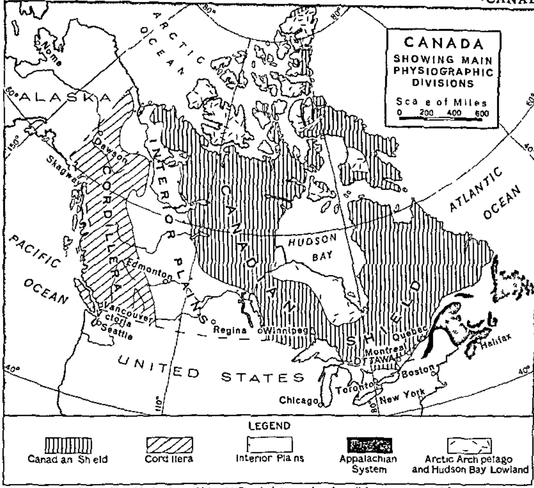


Each complete symbol represents 100,000 gainfully occupied

*No symbol because gainfully occupied were less than 50,000

agriculture, mining, logging, fishing, hunting
trade, transportation, communication, public utilities
manufacturing, construction, laborers
service

The top chart shows that more people in Canada worked in each of the major groups of occupations in 1951 than in 1891. The number, however, declined in proportion in the extractive industries—agriculture, mining, logging, fishing, and hunting. In 1891, half of all the gainfully occupied persons were in these occupations, but by 1951 they constituted only one fifth. The percentages of workers in trade, transportation, communication, and public utilities and in manufacturing and construction increased slightly. The largest gain occurred in service occupations—clerical, personal, protective, managerial, professional, and financial. The bottom chart shows chief occupations in each province.



This map shows the physiographic divisions which split Canada into a series of parallel regions separated from one another by mountains and forests Notice the very small area indicated with dots between the lower Great Lakes and along the St Lawrence River where 60 per cent of Canada s people live Contrast it with the vast expanse of the thinly populated Shield

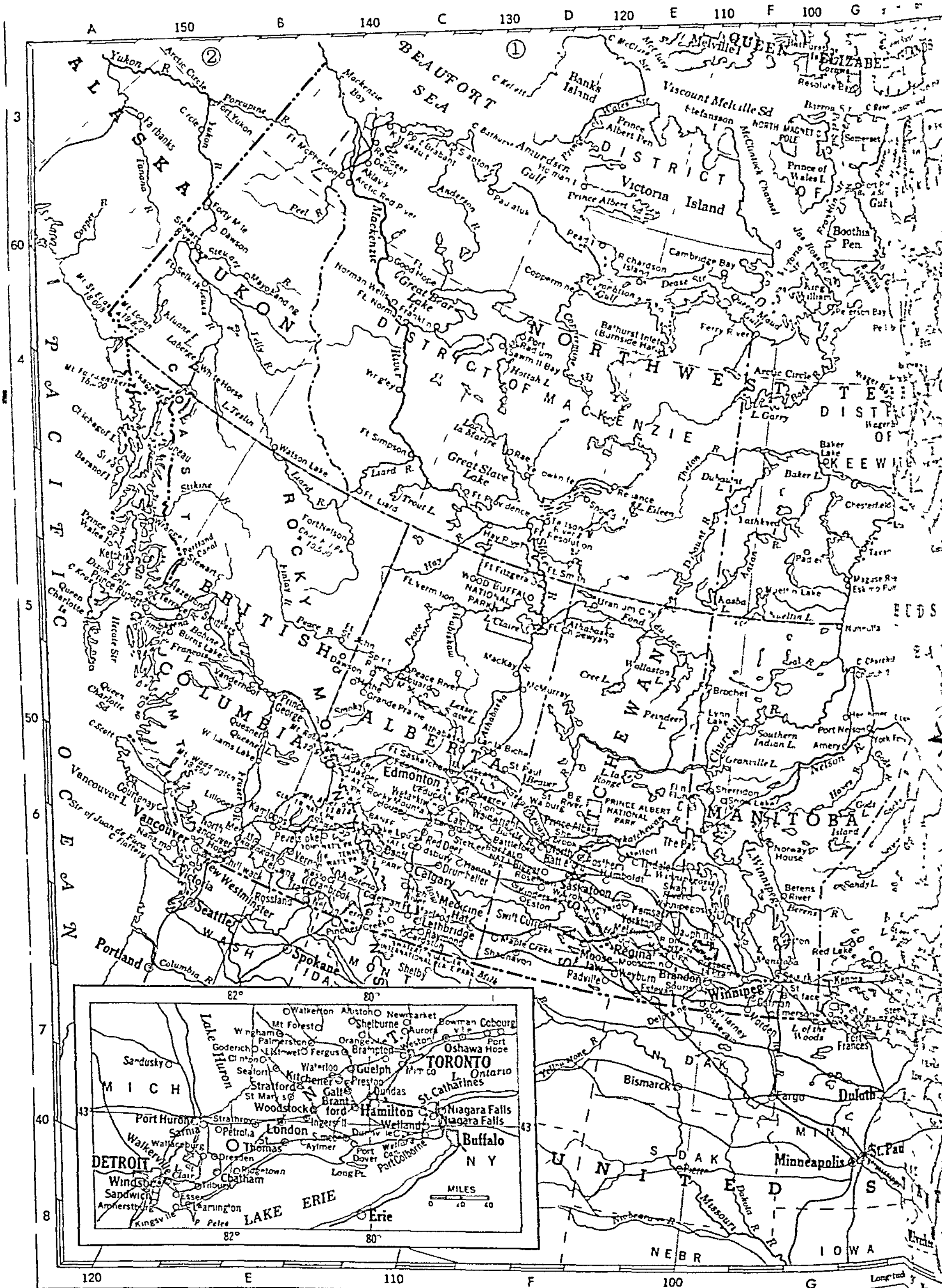
Across 4 000 miles of unfortified boundary the people of the two countries have migrated for generations—farmers of the western United States into the fertile lands of Alberta s Peace River country, the French farmers of Quebec to the mills of New England, the Ontario laborer to the factories of Detroit Tourists from the United States in 1951 numbered almost 25 million—about twice the total population of Canada They spent 258 million dollars a sum about one half the value of Canada s newsprint exports for that year The people of the United States have invested about 8 billion dollars in the development of Canada s mines forests and industries Canadians have about a billion dollars invested in the United States Two of the greatest trading nations in the world—each is the other s best customer and the flow of raw materials and manufactured goods across the boundary line is enormous

With so large a stake in each other's prosperity, so much of common interest, it is most desirable that the two countries should understand each other Let us look at the beautiful land that is Canada, and the people who have made it great

The Natural Divisions of Canada

Natural barriers running north and south, divide southern Canada into a series of parallel sections, each of which is separated from the other by hundreds of miles of virtually uninhabited wilderness Each communicates more easily with the corresponding region below the United States border than with the rest of Canada to the east or west The map above serves to make clear this peculiar geographical alignment of the country

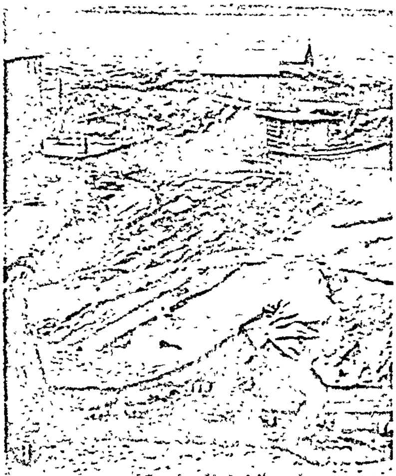
On the east coast the Appalachian Mountains reach northward from New England to the Gaspé Peninsula Their forested slopes cut off the Maritime Provinces of New Brunswick, Nova Scotia, and Prince Edward Island from the heavily populated St Lawrence River valley and Great Lakes region of Quebec and Ontario Across the continent the Rocky Mountains reach their

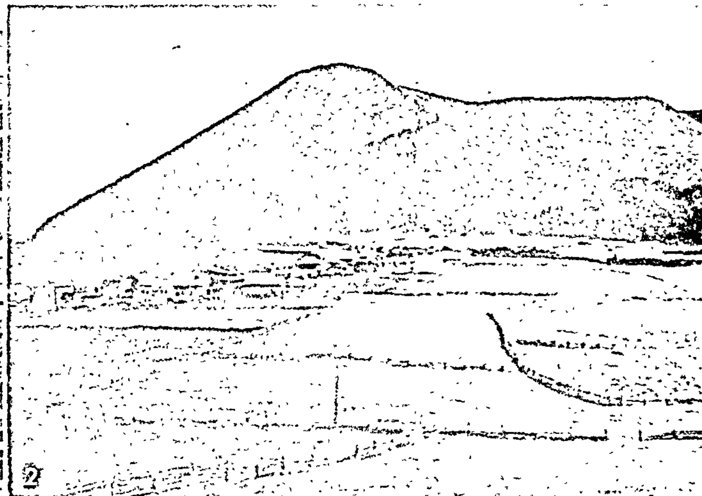


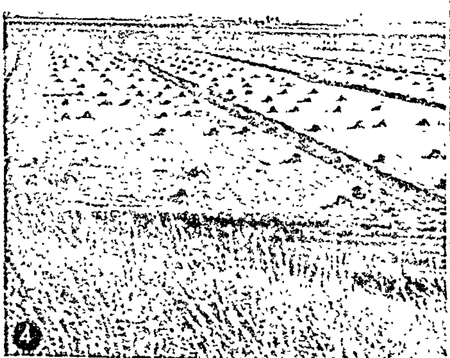
BEAUFORT SEA
ALASKA
YUKON
BRITISH COLUMBIA
ALBERTA
MANITOBA
DISTRICT OF MACKENZIE
NORTHWEST TERRITORIES
PACIFIC OCEAN
Victoria Island
Banks Island
Great Bear Lake
Great Slave Lake
Edmonton
Calgary
Vancouver
Victoria
New Westminster
Seattle
Portland
Spokane
Regina
Saskatoon
Winnipeg
Lethbridge
Medicine Hat
Brandon
Bismarck
Fargo
Duluth
Minneapolis
Fairbanks
Dawson
White Horse
Prince Rupert
Prince George
Kamloops
WOOD BUFFALO NATIONAL PARK
PRINCE ALBERT NATIONAL PARK
Lake Huron
LAKE ERIE
TORONTO
Hamilton
London
Kitchener
Guelph
Niagara Falls
St. Catharines
Buffalo
DETROIT
Windsor
Sarnia
Port Huron
Chatham
Erie
MICH
N Y
MILES

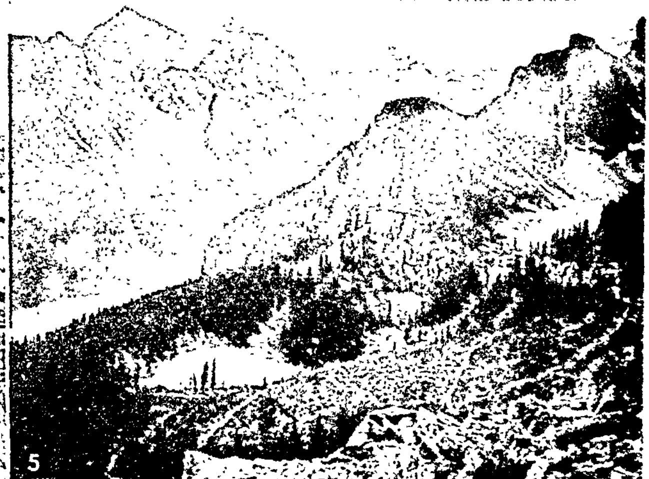

CANADA
SCALE OF MILES
SCALE OF KILOMETRES
Capitals of Countries
Provincial Capitals
International Boundaries
Provincial Boundaries
Railroads
GREENLAND
BAFFIN BAY
DAVIS STRAIT
FOXE BASIN
HUDSON BAY
Hudson Str.
ATLANTIC OCEAN
James Bay
Gulf of St. Lawrence
NEWFOUNDLAND
QUEBEC
ONTARIO
NEW BRUNSWICK
NOVA SCOTIA
PRINCE EDWARD I.
MAINE
MICHIGAN
PA
N.Y.
MASS.
CONN.
N.H.
VT.
MONTREAL
OTTAWA
TORONTO
Quebec
BOSTON
NEW YORK
DETROIT
Cleveland
Buffalo
Milwaukee
Hamilton
London
Windsor
Sarnia
Kingston
Sudbury
North Bay
Sault Ste. Marie
Lake Superior
Lake Huron
Lake Ontario
L. Erie
L. Michigan
Hal fax
Dartmouth
Sydney
Saint John
Fredericton
Sherbrooke
Three Rivers
Chicoutimi
Albany
Augusta
Montpelier
Southampton I.
Melville Pen.
Coral Harbour
Chesterfield Inlet
Cape Hopes Advance
Belcher Is.
Ungava Bay
Lake Mistassini
St. Jerôme
Lachute
St. Hyacinthe
Longueuil
Verdun
Granby
Beauharnois
St. Jean
Farnham
Valleyfield
Bedford
Sorel
Richmond
Joliette
West of Greenwich

A PICTURE JOURNEY ACROSS CANADA







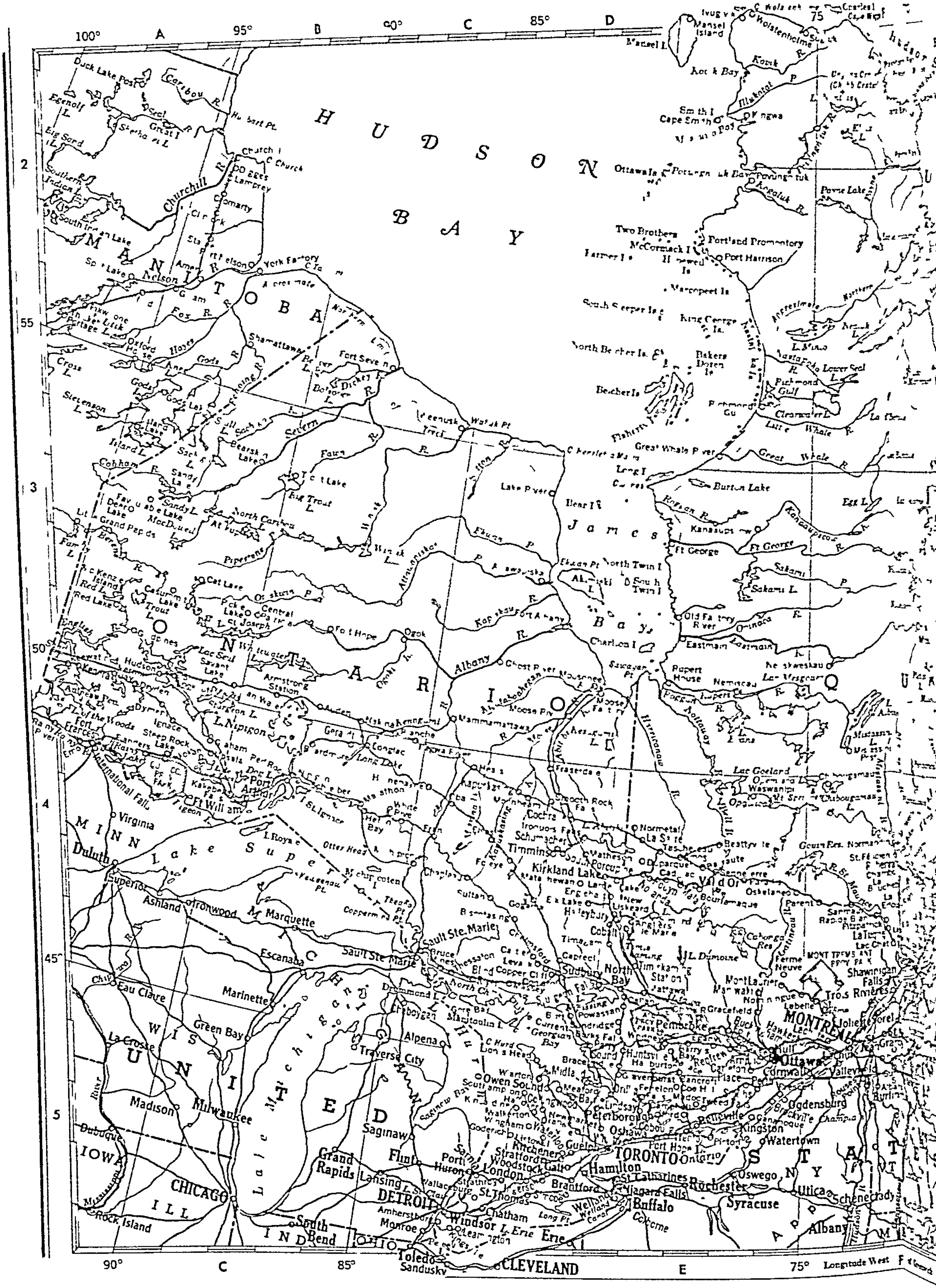


1. On the rocky coast of Nova Scotia, two fishermen prepare their nets for the sea. 2. In French-speaking Quebec the narrow "strip" farms, separated by wooden fences, run down to the common water highway, the St. Lawrence River; here the Laurentian Mountains crowd to the water's edge. 3. This air view of the forests and innumerable lakes of the Canadian Shield, in northern Ontario, makes it plain why so few people live in this area. 4. The wheat fields of Saskatchewan stretch for miles across the flat prairies. 5. A scene in the spectacular Rockies above Lake Louise; at the left is the Victoria Glacier.

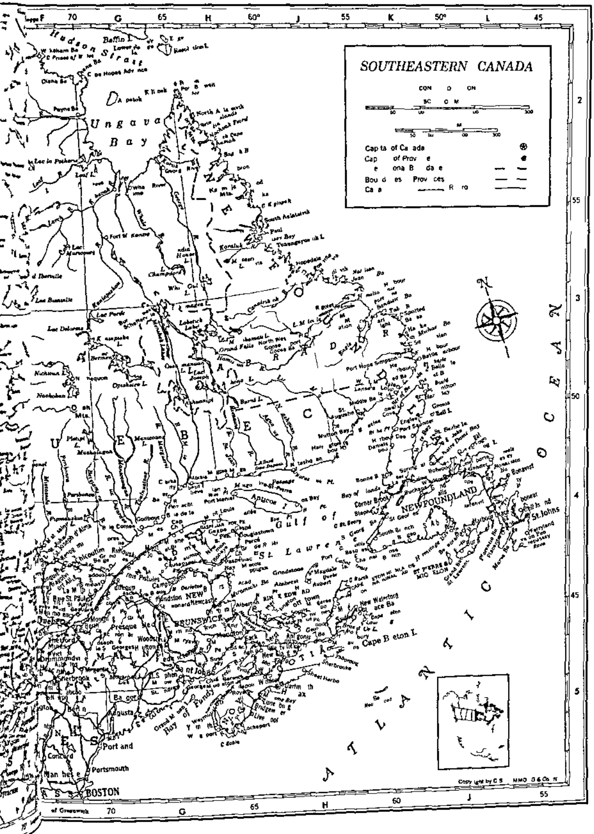
SOUTHEASTERN CANADA*

Abitibi (lake), Ont D 4
Abitibi (river) Ont D 3
Adlavik (islands), Newf J 2
Aguanus (river), Que H 3
Akimiski (isl) N W Terr D 3
Akpatok (isl), N W Terr G 1
Albanel (lake) Que F 3
Albany (river), Ont D 3
Alberton P E I 674 H 4
Algonquin (park) Ont F 4
Allan Water Ont C 3
Amherst N S 9 870 H 4
Amherst (island) Que H 4
Amherstburg Ont 3 638 D 5
Amos Que 4 265 E 4
Angliers Que 466 F 4
Anguille (cape) Newf J 4
Annapolis Royal, N S 784 H 5
Anticosti (island) Que 743 H 4
Antigonish N S 3 196 H 4
Argentia Newf 900 K 4
Armstrong Station Ont 375 C 3
Arnprior, Ont 4 381 F 4
Arvida Que 11 0 8 F 4
Asbestos Que 8 190 F 4
Ashuanipi (lake) Newf G 3
Atikokan Ont 1 591 B 4
Atikonak (lake) Newf H 3
Atikup Ont B 3
Attawapiskat Ont D 3
Attawapiskat (riv) Ont C 3
Attikamagen (lake) Newf G 3
Auden Ont 444 C 3
Aulneau (pen), Ont B 4
Avalon (pen), Newf K 4
Baffin (isl) N W Terr G 1
Bagotville Que 4 136 F 4
Baie Comeau Que 3 972 G 4
Baie de la Trinité Que 200 G 4
Baie St Paul Que 3 617 F 4
Bakers Dozen (islands) N W Terr E 2
Bancroft Ont 1 334 F 5
Barraute Que 500 E 4
Barrie Ont 12 514 E 5
Barry s Bay Ont 1 218 E 4
Bathurst N B 4 453 G 4
Batteau Lab Newf 63 J 3
Battle Har Lab Newf K 3
Bauld (cape) Newf K 3
Bay Roberts Newf 1 222 K 4
Bear (island), N W Terr D 3
Beardmore Ont 750 C 4
Bearskin Lake Ont B 3
Beattyville Que E 4
Beaver (lake) Ont C 2
Belcher (islands) N W Terr D 2
Bell (island) Newf 10 291 J 3
Bell (river) Que F 4
Bell Island, Newf 6 460 K 4
Belle (island) Newf K 3
Belle Isle (strait) Newf J 3
Belleoram Newf 663 J 4
Belleville Ont 19 519 E 5
Berens (river) Ont B 3
Bermen (lake) Que G 3
Berthier Que 200 F 4
Berwick N S 1 045 G 4
Betsiamites (river) Que F 3
Bic Que 1 086 G 4
Bienville (lake) Que F 2
Big Trout (lake) Ont C 3
Biscotasing Ont 200 D 4
Bishops Falls Newf 2 522 K 4
Blanche Ont C 3
Blind River Ont 2 512 D 4
Bolsover (lake) Ont C 2
Bonaventure, Que 2 500 G 4
Bonavista Newf 4 000 K 4
Bonavista (bay) Newf K 4
Bonne Bay, Newf 800 J 4
Botwood Newf 2 744 J 4
Bourlamaque Que 2 460 E 4
Bracebridge, Ont 2 684 D 4
Brantford Ont 36 727 D 5
Bras d Or (lake), N S H 4
Breton (cape), N S J 4
Bridgewater N S 4 010 H 5
Britt, Ont 225 D 4
Brockville Ont 12 301 E 5
Bruce Mines Ont 370 D 4
Buchans Newf 1 800 J 4
Buckingham Que 6 129 E 4
Burgeo Newf 891 J 4
Burin Newf 796 J 4
Burks Falls, Ont 891 E 4
Burnt (lake) H 3
Burnt Creek Que G 3
Burton (lake) Que E 3
Button (isls) N W Terr H 1
Cabonga (reservoir) Que E 4
Cabot (strait) H 4
Cadillac Que 1 514 E 4
Callander Ont 750 E 4
Campbellford Ont 3 235 E 5
Campbellton N B 7 754 G 4
Caniriktok (riv) Newf H 3
Canso N S 1 313 H 4
Cap Chat Que 1 642 G 4
Cape Breton (isl) N S 157 696 J 4
Cape Breton Highlands (park) N S J 4
Cape Hopes Advance Que G 1
Cape Smith N W Terr F 1
Capreol Ont 2 002 D 4
Caraquet N B 1 500 H 4
Carbonear Newf 3 351 K 4
Carleton (mt) N B G 4
Carleton Place Ont 4 725 F 4
Cartier Ont 507 D 4
Cartwright, Lab Newf 175 J 3
Casummit Lake Ont B 3
Cat Lake Ont B 3
Causapscal Que 2 400 G 4
Central Patricia Ont 230 C 3
Chaleur (bay) G 4
Chalk River Ont 300 F 4
Chambord Que 1 070 F 4
Champdoré (lake) Que G 2
Chandler Que 2 326 H 4
Channel Newf 2 634 J 4
Chapleau Ont 2 750 D 4
Charles (isl) N W Terr F 1
Charlottetown (capital) P E I 15 887 H 4
Charlton (island) N W Terr D 3
Chatham N B 6 223 G 4
Chatham Ont 21 218 D 5
Chelmsford Ont 1 210 D 4
Chibougamau (lake) Que F 4
Chibougamau Que F 4
Chicoutimi Que 23 210 F 4
Chidley (cape) Newf H 1
Chignecto (bay) G 4
Clarenville Newf 900 K 4
Clarke City Que 700 G 3
Clearwater (lake) Que E 2
Coaticook Que 6 341 F 4
Cobalt Ont 2 230 F 4
Cobham (river) B 3
Cobourg Ont 7 470 E 5
Cochrane Ont 3 401 D 4
Cod (island) Lab Newf H 2
Coe Hill Ont 288 E 5
Collingwood Ont 7 413 D 5
Coniston Ont 2 292 D 4
Copper Cliff Ont 3 974 D 4
Coppermine (point) Ont C 4
Corner Brook Newf 10 276 J 4
Cornwall Ont 16 899 E 4
Dalhousie N B 4 939 G 4
Daniels Harbour Newf 257 J 3
Dartmouth N S 15 037 H 5
Davis Inlet Lab Newf H 2
Deer Lake Ont B 3
Deer Lake Newf 2 655 J 4
Delorme (lake) Que F 3
Diana (bay), Que G 1
Diana Bay Que F 1
Dickey (river) Ont C 2
Digby N S 2 047 G 5
Dog (lake) Ont C 4
Dolbeau Que 4 307 F 4
Douglastown Que 779 H 4
Drummondville Que 14 341 F 4
Dryden Ont 2 627 B 4
Dumoine (lake) Que E 4
Duparquet Que 1 485 E 4
Dyment Ont 158 B 4
Eagle (riv), Lab Newf H 3
Eastmain Que E 3
Eastmain (river), Que F 3
Edgell (isl) N W Terr H 1
Edmundston N B 10 753 G 4
Eganville, Ont 1 326 E 4
Egg (lake) Que F 3
Ekwan (point) Ont D 3
Ekwan (river) Ont D 3
Elk Lake Ont 350 D 4
Elsas Ont 150 D 4
Emo Ont 653 B 4
Englee Newf 611 J 3
Englehart Ont 1 585 D 4
English (river) Ont B 3
Erie (lake) Ont D 5
Evans (lake) Que E 3
Farmer (isl) N W Terr D 2
Farnham Que 4 926 F 4
Favourable Lake Ont B 3
Fawn (river) Ont C 3
Fenelon Falls Ont 1 304 E 5
Ferme Neuve Que 1 660 E 4
Ferryland Newf 500 K 4
Fitzpatrick Que 300 F 4
Flaherty (island) N W Terr D 2
Flanders Ont 188 B 4
Flowers Cove Newf 800 J 3
Fogo Newf 1 078 K 4
Fogo (island) Newf 1 483 K 4
Foleyet Ont 500 D 4
Forestville Que 709 G 4
Fort Albany Ont D 3
Fort Chimo Que G 2
Fort Coulonge Que 1 431 E 4
Fort Frances Ont 8 038 B 4
Fort George Que E 3
Fort George (river) Que E 3
Fort Hope Ont C 3
Fort McKenzie Que G 2
Fort Severn Ont C 2
Fort William Ont 34 947 C 4
Forteau Lab Newf 250 J 3
Fortune (bay) Newf J 4
Fox Bay Anticosti I Que H 4
Fox Harbour Lab Newf 52 J 3
Franz Ont 75 D 4
Fraserdale Ont 150 D 4
Fredericton (capital) N B 16 018 G 4
Freels (cape) Newf K 4
Fundy (bay) G 5
Galt Ont 19 207 D 5
Gananoque Ont 4 572 E 5
Gander Newf 3 000 K 4
Gaspé Que 1 892 H 4
Gaspé (peninsula) Que G 4
Gaspesian (park) Que G 4
Gatineau (river) Que E 4
George (bay) N S H 4
George (river) Que G 2
George River Que G 2
Georgian (bay) Ont D 4
Geraldton Ont 3 227 C 4
Ghost River Ont D 3
Glace Bay N S 25 586 J 4
Godbout Que 600 G 4
Goderich Ont 4 834 D 5
Goeland (lake) Que E 3
Gogama Ont 500 D 4
Goldpines Ont B 3
Goose Airport (Goose Bay) Lab Newf 1 000 H 3
Gore Bay Ont 752 D 4
Gouin (reservoir) Que F 4
Gracefield Que 801 F 4
Graham Ont 49 B 4
Granby Que 21 989 F 4
Grand (lake) Newf J 4
Grand Bank Newf 2 148 J 4
Grand Falls Newf 5 508 J 4
Grand Falls, N B 2 365 G 4
Grand (falls) Newf H 3
Grand Manan (island) N B 2 897 G 5
Grand Rivière Que 932 H 4
Grande Vallée Que 459 H 4
Grandes Bergeronnes Que 743 G 4
Gravenhurst Ont 3 005 F 5
Great Whale River Que E 2
Great Whale (riv) Que E 2
Grindstone (island) Que 662 H 4
Groais (island) Newf J 3
Guelph Ont 27 386 D 5
Gulch (cape) Lab Newf H 2
Guysborough, N S 800 H 5
Haileybury Ont 2 346 D 4
Haliburton Ont 983 E 4
Halifax (cap) N S 85 589 H 5
Hamilton Ont 208 321 E 5
Hamilton (inlet) Newf J 3
Hamilton (river) Newf H 3
Hanover Ont 3 533 D 5
Harbour *Deep Newf 214* J 3
Harbour Grace Newf 2 331 K 4
Hare (bay) Newf J 3
Harricanaw (river) Que E 3
Harrington Harbour Que 163 H 3
Harrison (cape) Newf J 3
Hartland N B 1 000 G 4
Havre Aubert Magdalen Is Que 1 200 H 4
Havre-Saint Pierre Que 1 856 H 4
Hawke (island) Lab Newf J 3
Hawkesbury Ont 7 194 E 4
Hearst Ont 1 723 D 4
Heath (point) Que H 4
Hebron Lab Newf H 2
Henley Harbour Lab Newf J 3
Henrietta Maria (cape) Ont D 2
Heritage (bay) Newf J 4
Heron Bay, Ont 175 C 4
Hopedale Lab Newf 167 J 2
Hopewell (islands) N W Terr E 2
Hornepayne Ont 1 400 C 4
Howley Newf 500 J 4
Hudson Ont 700 B 3
Hudson (bay) C 2
Hudson (strait) G 1
Hull Que 43 483 E 4
Huntsville Ont 3 286 E 4
Hurd (cape), Ont D 4
Huron (lake) Ont D 5
Iberville (lake) Que F 2
Ignace Ont 300 B 4
Illukotat (river) Que E 1
Indian Harbour Lab Newf J 3
Indian House (lake) Que G 2
Ingersoll Ont 6 524 D 5
Ingonish N S 400 J 4
Inverness N S 2 360 H 4
Iroquois Falls Ont 1 342 D 4
Islands (bay) Newf J 4
Ivugivik Que E 1
James (bay) D 3
Jeanette (bay) Newf J 3
Joliette Que 16 064 F 4
Jones (cape) Que D 3
Jonquière Que 21 618 F 4
Joseph (lake) Newf G 3
Kaipokok Lab Newf 85 J 2
Kakabeka Falls, Ont 422 B 4
Kanaaupscow Que E 3
Kanaaupscow (riv) Que E 3
Kaniapiskau (lake) Que G 3
Kaniapiskau (river) Que G 2
Kapiskau (river) Ont D 3
Kapuskasing Ont 4 687 D 4
Kapuskasing (river) Ont D 4
Kaumajet (mts) Newf H 2
Keewatin Ont 1 634 B 3
Kenogami Que 9 895 F 4
Kenogami (river) Ont C 3
Kenora Ont 8 695 B 4
Kensington P E I 811 H 4
Kentville N S 4 240 H 4
Kesagami (lake) Ont D 3
Kiglapait (cape) Newf H 2
Killenek (island) G 1
Kincardine Ont 2 672 D 5
King George (islands) *N W Terr* E 2
Kingston Ont 33 459 E 5
Kingsville Ont 2 631 D 5
Kingwa Que E 1
Kirkland Lake Ont 19 191 D 4
Kitchener Ont 44 867 D 5
Klotz (lake) Que F 1
Koglauk (river) Que E 2
Koksoak (river) Que G 2
Koraluk (river), Newf H 2
Korok (river) Que G 2
Kovik (bay), Que E 1
Kovik (river) Que E 1
Kwataboahegan (river) D 3
La Malbaie Que 2 466 F 4
La Sarre Que 2 744 E 4
La Tuque Que 9 538 F 4
Labelle Que 1 007 E 4
Labrador 7 890 H 3
Lac au Saumon Que 1 622 G 4
Lac Bouchette Que 716 F 4
Lac Chat Que 88 F 4
Lac Edouard Que 250 F 4
Lac Frontière Que 619 G 4
Lachine Que 27 773 F 4
Lachute Que 6 179 F 4
Lake of the Woods Ont B 4
Lake River Ont D 3
Lanse au Loup Lab Newf J 3
Larch (river) Que F 2
Larder Lake Ont 1 464 E 4
Laurentides (park) Que F 4
Leaf (lake) Que G 2
Leaf (river) Que F 2
Leaf River Que G 2
Leamington Ont 6 950 D 5
Les Méchins Que 600 G 4
Levack, Ont 2 837 D 4
Lévis Que 13 162 F 4
Lewisporte Newf 1 219 K 4
Lindsay Ont 9 603 E 5
Lion s Head Ont 358 D 4
Listowel Ont 3 469 D 5
Little Current Ont 1 397 D 4
Little Mecatina (river) H 3
Little Whale (river) Que E 2
Liverpool N S 3 535 H 5
Lobstick (lake), Newf G 3
Lockeport N S 1 225 H 5
London Ont 95 343 D 5
Long (island) N W Terr D 3
Long (lake) Ont C 4
Long (point) Ont D 5
Longlac Ont 250 C 4
Louisburg N S 1 120 J 4
Lower Savage (islands) N W Terr G 1
Lower Seal (lake) Que F 2
Lunenburg N S 2 616 H 5
MacDowell (lake) Ont B 3
Madoc Ont 1 240 E 5
Magdalen (islands) Que 9 999 H 4
Magog Que 12 423 F 4
Magpie Que 155 H 3
Mahone Bay N S 1 019 H 5
Makkovik Lab Newf J 2
Malartic Que 5 983 E 4
Mammamattawa, Ont D 3
Manicouagan (lake) Que G 3
Manicouagan (riv) Que G 3
Manitoulin (island) Ont D 4
Maniwaki Que 3 535 E 4
Mansel (isl), N W Terr D 1
Mansel Isl N W Terr E 1
Marathon Ont 1 716 C 4
Marropeet (islands) N W Terr E 2
Margaree Harbour N S *400* H 4

*Population figures for places not listed in 1951 census courtesy Canad an Offic al Railway Guide (Montreal) Other populat on figures from 1951 census These are the latest official census figures ava lable



100°
95°
85°
75°
90°
HUDSON BAY
MANITOBA
ONTARIO
James Bay
UNITED STATES
MINN
WIS
IOWA
ILL
IND
OHIO
N Y
Lake Superior
Lake Michigan
Duluth
Superior
Ashland
Ironwood
Marquette
Escanaba
Marinette
Green Bay
Eau Claire
La Crosse
Madison
Milwaukee
Dubuque
CHICAGO
Rock Island
South Bend
Grand Rapids
Lansing
Saginaw
Flint
Port Huron
DETROIT
Monroe
Toledo
Sandusky
CLEVELAND
Erie
Buffalo
Niagara Falls
Rochester
Oswego
Syracuse
Utica
Schenectady
Albany
Watertown
Ogdensburg
Kingston
Belleville
Peterborough
Oshawa
TORONTO
Hamilton
St Catharines
Brantford
London
Woodstock
Stratford
Kitchener
Guelph
Galt
Chatham
Windsor
St Thomas
Owen Sound
Pembroke
Ottawa
Hull
MONTREAL
Cornwall
Sudbury
North Bay
Sault Ste Marie
Kirkland Lake
Timmins
Cochrane
Port Arthur
Ft William
International Falls
Virginia
Kenora
Dryden
Fort Frances
Churchill
York Factory
Fort Severn
Moose Factory
Fort Albany
Albany R.
Severn
Nelson
Hayes
Alpena
Cheboygan
Traverse City
Rupert House
Eastmain
Ft George
Great Whale River
Port Harrison
Val d'Or
Noranda
Timiskaming
Trois Rivieres
Joliette
Sorel
Longitude West



SOUTHEASTERN CANADA
Capital of Canada
Boundaries
Ungava Bay
Lac Delorme
Lac Bienville
Port Hope Simpson
Hopedale
South Aulatsivik
Goose Bay
Grand Falls
Corner Brook
NEWFOUNDLAND
St. Johns
Gaspé
Rimouski
BRUNSWICK
New Waterford
Sydney
Cape Breton I.
Sherbrooke
Augusta
Presque Isle
Moncton
Bay of Fundy
Concord
Portsmouth
BOSTON

Marguerite (river), Que. G 3
Maricourt (lake), Que. F 2
Marysville, N. B. 2,152 G 4
Massey, Ont. 937 D 4
Matachewan, Ont. 1,000 D 4
Matane, Que. 6,345 G 4
Matapédia, Que. 500 G 4
Matheson, Ont. 675 D 4
Mattawa, Ont 3,097 E 4
McCormack (island), N.W. Terr. D 2
McKenzie Island, Ont. 1,450 B 3
Meaford, Ont. 3,178 D 5
Mealy (mts.), Newf. J 3
Mecatina (cape), Que. J 3
Mégantic, Que. 6,164 F 4
Melville (lake), Newf. J 3
Menihek (lakes), Newf. G 3
Mesgouez (lake), Que. E 3
Michikamau (lake), Newf. H 3
Michipicoten, Ont. C 4
Michipicoten (isl.), Ont. C 4
Middle Bay, Que. J 3
Middleton, N. S. 1,506 G 5
Midland, Ont. 7,206 D 5
Mille Lacs (lake), Ont. B 4
Milltown, N. B. 2,267 G 4
Mingan, Que. 60 H 3
Mingan (passage), Que. H 4
Minto, N. B. 850 G 4
Minto (lake), Que. F 2
Miramichi (bay), N. B. H 4
Miscou (island), N. B. H 4
Missinaibi (river), Ont. D 4
Mistassibi (river), Que. F 3
Mistassini, Que. 2,298 F 4
Mistassini (lake), Que. F 3
Mistassini (river), Que. F 4
Mistassini Post, Que. F 3
Mistastin (lake), Newf. H 2
Moisie, Que. 351 G 3
Moisie (river), Que. G 3
Moncton, N. B. 27,334 G 4
Mont Joli, Que. 4,938 G 4
Mont Laurier, Que. 4,701 E 4
Mont Louis, Que. 500 G 4
Mont Tremblant (park), Que. F 4
Montague, P. E. I. 1,068 H 4
Montmagny, Que. 5,844 G 4
Montmorency, Que. 5,817 F 4
Montreal, Que. 1,021,520 F 4
Moonbeam, Ont. 500 D 4
Moose (river), Ont. D 3
Moose Factory, Ont. 400 D 3
Moose River, Ont. D 3
Moosonee, Ont. 300 D 3
Mosquito (bay), Que. E 1
Mulgrave, N. S. 1,212 H 4
Mushalagan (lake), Que. G 3
Mutton Bay, Que. 110 J 3
Nachvak (fjord), Newf. H 2
Nain, Lab., Newf. H 2
Nakina, Ont. 500 C 3
Nantais (lake), Que. F 1
Naokokan (lake), Que. F 3
Nastapoka (islands), N.W. Terr. E 2
Nastapoka (river), Que. E 2
Natashquan, Que. 435 H 3
Natashquan (pt.), Que. H 4
Natashquan (river), Que. H 3
Nedluk (lake), Que. F 2
Nemiscau, Que. E 3
Neoskweskau, Que. E 3
New Brunswick (province) 515,697 G 4
New Glasgow, N. S. 9,933 H 4
New Liskeard, Ont. 4,215 E 4
New Richmond, Que. 1,000 G 4
New Waterford, N.S. 10,423 J 4
Newcastle, N. B. 4,248 G 4
Newfoundland (province) 361,416 J 4
Newmarket, Ont. 5,356 D 5
Niagara Falls, Ont. 22,874 E 5
Nichicun (lake), Que. F 3
Nicolet, Que. 4,084 F 4
Nipigon, Ont. 700 C 4
Nipigon (lake), Ont. C 4
Nipissing (lake), Ont. D 4
Nitchequon, Que. F 3
Nominingue, Que. 726 E 4
Noranda, Que. 9,672 E 4
Normandin, Que. 1,678 F 4
Normetal, Que. 600 E 4
North (cape), N. S. J 4
North (channel), Ont. D 4
North (point), P. E. I. H 4
N. Aulatsivik (island), Newf. H 2
N. Bay, Ont. 17,944 E 4
N. Belcher (islands), N.W. Terr. D 2
N. Caribou (lake), Ont. B 3
N. Twin (island), N.W. Terr. D 3
North West River, Lab., Newf. 400 H 3
Northumberland (strait) H 4
Notre Dame (bay), Newf. J 4
Notre Dame (mt.), Que. G 4
Nottaway (river), Que. E 3
Nova Scotia (province) 642,584 H 4
Nutak, Lab., Newf. H 2
Oba, Ont. 75 D 4
Ogoki, Ont. C 3
Ogoki (river), Ont. C 3
Okak (islands), Newf. H 2
Old Factory River, Que. E 3
Ontario (lake), Ont. E 5
Ontario (prov.) 4,597,542 C 3
Opawica (lake), Que. E 4
Opemisca (lake), Que. E 4
Opinaca (river), Que. E 3
Opisketeo (lake), Que. G 3
Orangeville, Ont. 3,249 D 5
Orillia, Ont. 12,110 E 5
Oshawa, Ont. 41,545 E 5
Oskelaneo, Que. 250 E 4
Ossokmanuan (lake), Newf. G 3
Otish (mt.), Que. F 3
Otoskwin (river), Ont. C 3
Ottawa (islands), N.W. Terr. D 2
Ottawa (river) E 4
Ottawa (cap.), Canada 202,045 E 4
Otter Head (promontory), Ont. C 4
Outardes (river), Que. G 4
Owen Sound, Ont. 16,423 D 5
Paradis, Que. 200 E 4
Parent, Que 1,255 E 4
Parrsboro, N. S. 1,906 H 4
Parry Sound, Ont. 5,183 E 4
Paspébiac, Que. 800 H 4
Paul (isl.), Lab., Newf. H 2
Payne (lake), Que. F 2
Payne (river), Que. F 2
Payne Bay, Que. F 1
Pegwa River, Ont. D 4
Pelee (island), Ont. D 5
Pembroke, Ont. 12,704 E 4
Percé, Que. 700 H 4
Peribonca (lake), Que. F 3
Peribonca (river), Que. F 3
Perth, Ont. 5,034 E 5
Peterborough, Ont. 38,272 E 5
Petitcodiac, N. B. 900 G 4
Pickle Lake, Ont. B 3
Picton, Ont. 4,287 E 5
Pictou, N. S. 4,259 H 4
Pigeon (river), Ont. B 4
Pipestone (river), Ont. B 3
Pipmauskin (lake), Que. F 4
Pistolet (bay), Newf. J 3
Placentia, Newf. 900 K 4
Placentia (bay), Newf. K 4
Pletipi (lake), Que. F 3
Porcupine (cape), Newf. J 3
Porée (lake), Que. G 3
Port Alfred, Que. 3,937 F 4
Port Arthur, Ont. 31,161 C 4
Port aux Basques, Newf. 2,634 H 4
Port Burwell, N.W. Terr. H 1
Port Colborne, Ont. 8,275 E 5
Port Harrison, Que. E 2
Port Hawkesbury, N. S. 1,034 H 4
Port Hood, N. S. 636 H 4
Port Hope, Ont. 6,548 E 5
Port Hope Simpson, Lab., Newf. J 3
Port Menier, Anticosti I., Que. 125 H 4
Port Saunders, Newf. 350 J 3
Portland (promontory), Que. E 2
Postville, Lab., Newf. 16 J 2
Potherie, La (lake), Que. F 2
Povungnituk, Que. E 2
Povungnituk (bay), Que. E 2
Povungnituk (riv.), Que F 1
Powassan, Ont. 832 E 4
Prescott, Ont. 3,518 E 5
Prince Edward Island (province) 98,429 H 4
Prince of Wales (cape), Que. F 1
Quebec (prov.) 4,055,681 G 3
Quebec (cap.), Que. 164,016 F 4
Quetico (park), Ont. B 4
Race (cape), Newf. K 4
Rainy (lake), Ont. B 4
Rainy (river), Ont. B 4
Rainy River, Ont. 1,348 B 4
Ramah (bay), Newf. H 2
Rapide Blanc, Que. 190 F 4
Ray (cape), Newf. J 4
Red (lake), Ont. B 3
Red Bay, Lab., Newf. J 3
Red Lake, Ont. B 3
Red Rock, Ont. 1,411 C 4
Renfrew, Ont. 7,360 E 4
Resolution (island), N.W. Terr. H 1
Riche (point), Newf. J 3
Richibucto, N. B. 1,158 G 4
Richmond (gulf), Que. E 2
Richmond Gulf, Que. E 2
Rigolet, Lab., Newf. J 3
Rimouski, Que. 11,565 G 4
Rivière Bleue, (St. Joseph) Que. 1,334 G 4
Rivière du Loup, Que. 9,425 G 4
Rivière Pentecôte, Que. 250 G 4
Roberval, Que. 4,897 F 4
Roggan (river), Que. E 3
Romaine (river) H 3
Rose Blanche, Newf. 950 J 4
Rossignol (lake), N. S. G 5
Rothesay, N. B. 896 G 4
Rouyn, Que 14,633 E 4
Rupert (river), Que. E 3
Rupert House, Que. E 3
Sable (cape), N. S. G 5
Sable (island), N. S. J 5
Sachigo (lake), Ont. B 3
Sackville, N. B. 2,873 H 4
Saglek (bay), Lab., Newf. H 2
Saguenay (river), Que. F 4
St. Albans, Newf. 800 J 4
St. Andrews, N. B. 1,458 G 5
St. Anthony, Newf. 1,380 K 3
St Augustin, Que. 372 J 3
St. Barbe (isls.), Newf. J 3
St. Catharines, Ont. 37,984 E 5
St. Charles (cape), Newf. K 3
St. Clair (lake), Ont. D 5
St. Félicien, Que. 2,656 F 4
St. George, N. B. 1,263 G 5
St. George (cape), Newf. J 4
St. Georges, Newf. 750 J 4
St. Georges (bay), Newf. J 4
St. Hyacinthe, Que. 20,236 F 4
St. Ignace (island), Ont C 4
St Jean, Que. 19,305 F 4
St Jean (river), Que. H 3
St Jean Port Joli, Que. 900 G 4
St. Jérôme, Que. 17,685 F 4
St. John's (cap.), Newf. 52,873 K 4
Saint John, N. B. 50,779 G 4
St. John (cape), Newf. J 3
St. John (lake), Que. F 4
Saint John (river), N. B. G 4
St. Joseph, Que. 2,417 F 4
St. Joseph (lake), Ont. B 3
St. Joseph d'Alma, Que. 7,975 F 4
St. Lawrence, Newf. 1,451 J 4
St. Lawrence (gulf) H 4
St. Lawrence (river) F 4
St. Léonard, N. B. 1,419 G 4
St. Marys (bay), Newf. K 4
St. Maurice (river), Que. F 4
St. Michaels (bay), Newf. K 3
St. Pacôme, Que. 1,197 G 4
St. Pascal, Que. 1,736 G 4
St. Siméon, Que. 1,103 F 4
St. Stephen, N. B. 3,769 G 4
St. Thomas, Ont. 18,173 D 5
Ste. Anne de Beaupré, Que. 1,827 F 4
Ste. Marie, Que. 2,431 F 4
Sakami (lake), Que. E 3
Sakami (river), Que. E 3
Sand (lake), Ont. B 3
Sandwich (bay), Newf. J 3
Sandy (lake), Ont. B 3
Sandy Lake, Ont. B 3
Sanmaur, Que. 163 F 4
Sarnia, Ont. 34,697 D 5
Sault Ste. Marie, Ont. 32,452 D 4
Savant Lake, Ont. 97 B 3
Sawayan (point), Que. E 3
Schefferville, Que. G 3
Schreiber, Ont. 1,850 C 4
Schumacher, Ont. 3,002 D 4
Senneterre, Que. 1,686 E 4
Separation Point, Lab., Newf. 51 J 3
Sept Iles (Seven Islands), Que. 1,866 G 3
Seul (lake), Ont. B 3
Seven Islands (Sept Iles), Que. 1,866 G 3
Seven Islands (bay), Newf. H 2
Severn (river), Ont. C 3
Shawinigan Falls, Que. 26,903 F 4
Shediac, N. B. 2,010 H 4
Sheet Harbour, N. S. 1,500 H 5
Shelburne, N. S. 2,040 H 5
Shelter Bay, Que. 450 G 3
Sherbrooke, Que. 50,543 F 4
Sherbrooke, N. S. 500 H 5
Shippigan (island), N. B. 6,876 H 4
Simard (lake), Que. E 4
Simcoe, Ont. 7,269 D 5
Sioux Lookout, Ont. 2,364 B 3
Smith (isl.), N.W. Terr. E 1
Smiths Falls, Ont. 8,441 E 5
Smooth Rock Falls, Ont. 1,102 D 4
Sorel, Que. 14,961 F 4
Souris, P. E. I. 1,183 H 4
South (point), Que. H 4
South Aulatsivik (island), Newf. H 2
South Branch, Newf. 200 J 4
South Porcupine, Ont. 5,618 D 4
South Sleeper (islands), N.W. Terr. D 2
South Twin (island), N.W. Terr. E 3
Southampton, Ont. 1,700 D 5
Spotted Islands, Lab., Newf. 45 J 3
Springdale, Newf. 800 J 4
Springer (mt.) Que. F 4
Springhill, N. S. 7,138 H 4
Square Island, Lab., Newf. K 3
Stephenville, Newf. 1,200 J 4
Stratford, Ont. 18,785 D 5
Strathroy, Ont. 3,708 D 5
Stull (lake), Ont. B 3
Sturgeon (lake), Ont. B 4
Sturgeon Falls, Ont. 4,962 D 4
Sudbury, Ont. 42,410 D 4
Sugluk, Que. F 1
Sultan, Ont. 125 D 4
Summerside, P. E. I. 6,547 H 4
Sundridge, Ont. 634 E 4
Superior (lake), Ont. C 4
Sussex, N. B. 3,224 G 4
Sutton, Que. 1,389 F 4
Sutton (river), Ont. D 3
Sydney, N. S. 31,317 H 4
Sydney Mines, N. S. 8,410 H 4
Table (bay), Newf. J 3
Tadoussac, Que. 1,064 F 4
Taschereau, Que. 1,000 E 4
Thessalon, Ont. 1,595 D 4
Thetford Mines, Que. 15,095 F 4
Timagami, Ont. 500 D 4
Timiskaming (lake) E 4
Timiskaming Station, Que. 2,781 E 4
Timmins, Ont. 27,743 D 4
Torngat (mts.), Newf. H 2
Toronto (capital), Ont. 675,754 E 5
Toulnustouc (river), Que. G 3
Tracadie, N. B. 1,500 H 4
Trenton, Ont. 10,085 E 5
Trenton, N. S. 3,089 H 4
Trepassey, Newf. 570 K 4
Trinity, Newf. 800 K 4
Trinity (bay), Newf. K 4
Trois Pistoles, Que. 3,537 G 4
Trois-Rivières, Que. 46,074 F 4
Trout (lake), Ont. B 3
Trout Lake, Ont. C 3
Truro, N. S. 10,756 H 4
Tunungayualuk (island), Newf. J 2
Tweed, Ont. 1,562 E 5
Twillingate, Newf. 2,100 K 4
Two Brothers (islands), N.W. Terr. D 2
Ungava (bay), Que. G 2
Upsala, Ont. 190 C 4
Val Brillant, Que. 867 G 4
Val d'Or, Que. 8,685 E 4
Valleyfield, Que. 22,414 F 4
Vermilion Bay, Ont. 98 B 3
Victoriaville, Que. 13,124 F 4
Ville Marie, Que. 1,316 E 4
Ville St. Georges, Que. 2,657 G 4
Voisey (bay), Newf. H 2
Wabuk (point), Ont. D 2
Wakeham Bay, Que. F 1
Walkerton, Ont. 3,264 D 5
Wallace, Ont. E 4
Wallaceburg, Ont. 7,688 D 5
Waswanipi, Que. E 4
Waterloo, Ont. 11,991 D 5
Wedgeport, N. S. 1,322 G 5
Weenusk, Ont. C 2
Weggs (cape), Que. F 1
Welland, Ont. 15,382 E 5
Welland (canal), Ont. E 5
Wesleyville, Newf. 1,304 K 4
West (point), Que. G 4
West St. Modeste, Lab., Newf. 73 J 3
Westville, N. S. 4,301 H 4
Weymouth, N. S. 1,500 G 5
Whale (river), Que. G 2
Whale River, Que. G 2
Whitby, Ont. 7,267 E 5
White (bay), Newf. J 3
White Gull (lake), Que. G 2
White River, Ont. 401 C 4
Whitewater (lake), Ont. C 3
Whitney, Ont. 247 E 4
Wiarton, Ont. 1,955 D 5
Windsor, Ont. 120,049 D 5
Windsor, Newf. 3,674 J 4
Windsor, N. S. 3,439 H 5
Wingham, Ont. 2,642 D 5
Winisk (lake), Ont. C 3
Winisk (river), Ont. C 3
Wolfville, N. S. 2,313 H 4
Wolstenholme, Que. E 1
Wolstenholme (cape), Que. E 1
Woodstock, Ont. 15,544 D 5
Woodstock, N. B. 3,996 G 4
Yarmouth, N. S. 8,106 G 5

highest elevations in Canada, rising in a tremendous wall between the west coast province of British Columbia and the interior Prairie Provinces of Alberta, Saskatchewan, and Manitoba

The Laurentian Plateau

An even greater barrier to east-west lines of communication is the Laurentian Plateau, or Canadian Shield, a mass of rock which splits the central part of the country like a giant wedge. This plateau, blanketed in forests and spangled with thousands of lakes, occupies two thirds of Canada's land area It is called the Shield from its appearance when it is drawn on a map It covers all of eastern Canada down to the St Lawrence River Its western border extends from the Arctic Ocean southeast along Great Bear, Great Slave, Athabaska, and Winnipeg lakes to the Great Lakes Its precipitous southeastern edge, known as the Laurentide Mountains, rises 6000 feet in some places (see Laurentian Plateau)

Thus we find the southern portion of Canada divided into four regions The Maritime Provinces are very similar to New England The Ontario peninsula and the St Lawrence River valley of Quebec are similar to nearby Michigan, Ohio, and New York Canada has no Middle West that corresponds to the Middle West of the United States It has instead a great forest nearly a thousand miles wide—the forest of the Canadian Shield Then come the prairies, which are a continuation of the plains of North Dakota and Montana And finally there is the Pacific coast region, continuous with the state of Washington

The Maritime Provinces

Like New England, the Maritime Provinces and Newfoundland have rocky coasts behind which rise the forested slopes of the Appalachians In sheltering coves lie fishing villages, once the haunt of privateers, and still full of thrilling tales of adventure at sea Out of Lunenburg and Halifax in the fog thick dawn slip the schooners and motor ships bound for the coastal fisheries, and the distant Grand Banks with their swarming shoals of cod and herring Cattle graze in the tidal marshes behind protecting dikes And up the Bay of Fundy are the beautiful valleys of Annapolis and Cornwallis, sweet with apple orchards and hay fields Prince Edward Island is the "Garden of the Gulf," but most of the people of the Maritime Provinces earn their living from the sea The population is largely English Scottish and Irish in ancestry, with a large French minority in New Brunswick

These provinces are cut off by the sea and by the Appalachian Mountains from the rest of Canada Their only access to Montreal is by rail or air across the "foreign" state of Maine, or by ship through the Gulf of St Lawrence and up the St Lawrence River This route is closed by ice in the winter, and the all-Canadian rail lines are so long and indirect that they are little used for passenger travel

Because of their isolation the provinces have been slow to develop industrially, but progress has been made during World War II and the postwar period Nova Scotia has Canada's largest gypsum deposits and is second to Alberta in coal production At Sydney on Cape Breton Island coal is mined for miles under the ocean floor Newfoundland has one of the world's great iron-ore fields Extensive deposits of lead, zinc, and copper have been found in New Brunswick

St Lawrence River—Great Lakes Region

The St Lawrence Valley is a belt of soft rocks between the hard rocks of the Shield on the northwest and the Adirondack and Appalachian mountains on the southeast The soft rocks have weathered away, leaving a lowland with rich soil between two highland areas At Quebec the valley is only 20 miles wide It broadens to 70 miles at Montreal, then narrows again at the eastern end of Lake Ontario

Most of the farmers of the St Lawrence Valley are French Roman Catholics Their farms are small, only a hundred acres or so, in narrow strips running back from the river toward the Laurentides on the one shore, the Appalachians on the other Charming little villages line the river shores, each with a spotless church rising white against the blue line of hills Travelers up and down the St Lawrence never forget the mellow clanging of the church bells They seem to be the voice of French Canada Wayside shrines, outdoor bake ovens, slow plodding ox teams make this part of Canada seem like a bit of old France

Montreal, at the head of ocean navigation on the St Lawrence is Canada's second largest city and one of the largest inland seaports in the world The old-world city of Quebec, and Ottawa capital of the nation on the Ottawa River, are also in this region

Crowded between the southern edge of the Laurentian Plateau and the border of the United States, from the lower Great Lakes to the city of Quebec live more than half of all Canadians In this area are 70 per cent of all the cities and more than 80 per cent of the manufacturing Here is Toronto, Canada's largest city This region uses almost 80 per cent of the goods imported into Canada It produces almost half the value of the farm products of the nation

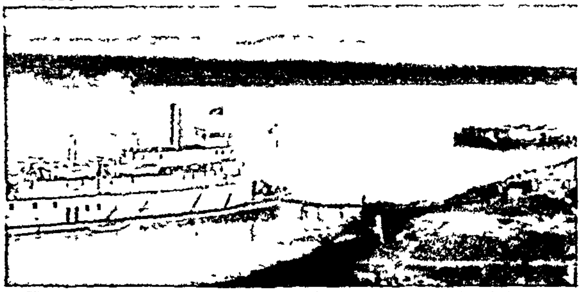
Why is such a small part of Canada—only one per cent of its area—so predominant? The answer is that it provides the easiest living conditions The peninsula in southeastern Ontario that juts southward between Lakes Ontario and Erie on the east and Lake Huron on the west, is a prosperous farming area Like Michigan and New York, it has fertile orchards, vineyards and pastures, protected by moderate lake winds from severe winters and early frosts Power from the countless rushing streams of the higher plateau on the north operates its factories, and it shares with the United States the power generated at Niagara Falls Three of the country's four leading manufacturing cities are in this peninsula—Toronto, Hamilton, and London Its people are for the most part British and Protestant

The Western Prairies

From Toronto, the heart of Canada's industrial area, to Winnipeg on the edge of the prairies, is a longer trip than from New York to Chicago The prairies lie west of the Plateau and extend up to the Arctic tundra

The southern part of these plains is a flat and treeless country. Farther north, around the Peace and Hay rivers, the land becomes parklike, with clumps of evergreens and aspens interrupting its level expanse. Still farther north, the Mackenzie River valley is heavily forested. The plains slope gently downward from the border toward the Mackenzie Valley and Hudson Bay to the north and northeast.

AKLAVIK NEAR THE ARCTIC OCEAN



A Hudson's Bay Company steamer photographed by the light of the midnight sun at Aklavik, in the Mackenzie River delta.

The southern prairie wheat farms lie in great blocks a mile square. The view of waving grain in summer, or drifting snow in winter stops only at the horizon. Sharply outlined against the sky rises a grain elevator. A cluster of farm buildings, with their tall windmill, seems to have fallen by accident onto the empty land. Far different are these from the neat little farms of the St. Lawrence, hemmed in between river shore and mountain, or the sea-sprayed pastures of the Maritime Provinces.

The Prairie Provinces are thinly populated. All three combined have fewer people than the city of Chicago. The largest city is Winnipeg, an important railroad center and grain and livestock market. Edmonton in central Alberta is an outfitting point for prospectors, trappers, and farmers of the Peace River country. Large deposits of oil, natural gas, and coal in Alberta point to a great industrial future.

The Pacific Coast

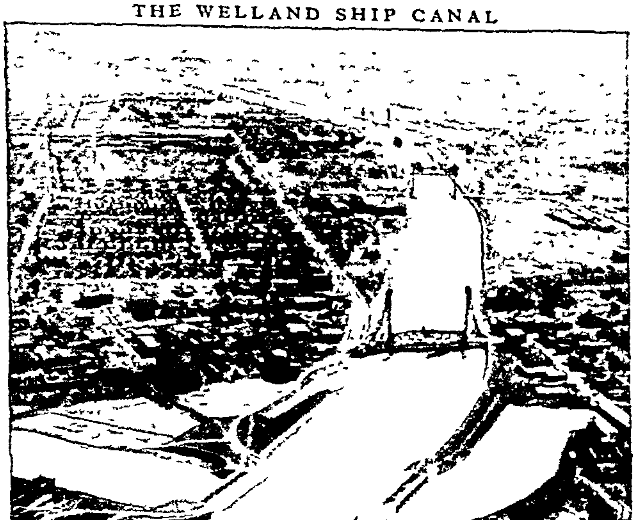
Canada's Pacific coast region is a spectacular upheaval of mountains. The Rockies cut across the Alberta-British Columbia border. Farther west, the Coast Range steps directly out of the sea, forest-covered and snow peaked. Narrow, winding fiords slash far back into the mountains from the coast, and countless islands fringe the shore. In the Inland Passage between these islands and the mainland live myriads of fish. Between the Coast Range and the Rockies lies a plateau broken by numerous smaller ranges. There is some agriculture in the Fraser, Okanagan, and other interior valleys, but not more than one tenth of British Columbia can be farmed. Fishing, fish canning, and lumbering are the chief industries of the region.

Vancouver and Victoria, near the United States border, are the leading cities. Most of the coast, however, is too steep and wild for the development of great commercial centers.

The Far North

We have made a brief journey across southern Canada where most of the people live. But the greater part of the country is forest, marsh, and Arctic meadow extending to the polar seas. For three centuries this was the undisputed land of the French and Indian trappers, the Eskimo nomad, and the missionary. The trading posts of the Hudson's Bay fur company were the farthest outposts of civilization. Canoes, snowshoes, and dog sleds were the only means of transportation.

THE WELLAND SHIP CANAL



The Welland Ship Canal cuts across the isthmus between Lake Erie and Lake Ontario, by-passing Niagara Falls. Seven locks lift vessels 326 feet. This view looks south across the town of Welland toward Lake Erie.

Today the airplane is opening the northland to an exciting future. The roar of motors now shatters the silence of the great forests. Lakes and rivers are year-round landing fields for planes equipped with pontoons and skis. Mining towns and dam sites are springing up in the wilderness, their food, building materials, machinery, and the engineers and workmen, all flown in by cargo planes. Yellowknife on Great Slave Lake, over on the western edge of the Shield, burst into existence in 1938 with the discovery of gold. Up the Saguenay River in eastern Quebec the great Shipshaw Power Development includes a series of dams and storage reservoirs which generate the power for one of the world's biggest aluminum reduction plants. This is the country of which Louis Hémon wrote in his beautiful story of 'Maria Chapdelaine'. Maria would never recognize today the quiet woods where men died when they strayed from the trail.

Not only is the airplane opening up the north to industrial development, but it is also destined to make this area an essential link of the global air lanes. The shortest distance between any part of the continent of Asia and the eastern or central United States

lies across northern Canada *Across here too must* pass straight-line flights between the West coast of the United States and many of the great cities of northern Europe (*see* Aviation)

Even the farmer is beginning to discover the possibilities of the northern prairies Federal agricultural experts declare that the Hay River valley is one *of the best cereal and mixed farming regions of* Canada, yet it is practically uninhabited Toward the Arctic Circle, summer daylight is almost continuous for three months and temperatures reach 100° Vegetables grow rapidly under such conditions and reach enormous size At Aklavik in the Mackenzie River delta, 130 miles beyond the Arctic Circle oats, barley, hay, garden vegetables, and cattle are being successfully raised The winters are longer but in many places no colder than in the state of Vermont There is less snow in the Mackenzie Valley than in the Maritime Provinces As farmers miners and pilots penetrate the north misconceptions which have hindered its development are being dispelled It may truly be called the ' land of the future "

Waterways and Water Power

The early French voyageurs who came out of the interior with canoe loads of beaver skins appreciated the advantages of Canada's network of waterways Its rivers and lakes are still the only avenues of transportation over thousands of square miles not yet reached by road or railroad As a source of power for the growing industries and as a means of recreation for the vacationing workers of two nations, their value is inestimable

The interior of Canada holds half the fresh water of the world, totaling 6 per cent of the country's area Hudson Bay bites another 250 000 square miles out of the northern part of the continent The coast line along the Atlantic, Pacific, and Arctic oceans Hudson Bay, and Hudson Strait totals 17 863 miles

Tens of thousands of lakes lie in the glacier-gouged depressions of the Shield In one accurately mapped area of 5 300 square miles 7 500 lakes have been counted In addition to the Great Lakes Canada has 11 lakes each of which has 1 000 square miles or more Great Bear Lake, Great Slave Lake, and Lake Winnipeg are each larger than the state of Massachusetts

The St Lawrence Great Lakes waterway reaches 2 400 miles inland, almost half way across the continent This superb highway to the sea teems with the commerce of two nations It gives the land locked prairies a world market for their wheat and carries to them the manufactured products of the East The twin ports of Port Arthur Fort William, at the west end of Lake Superior, are the largest grain-shipping points in the world At Sault Sainte Marie, between Lake Superior and Lake Huron, Canada has its own canal paralleling the one on the United States side of the St Mary River Canals have been built around the numerous rapids in the upper St Lawrence The Welland Ship Canal carries vessels around Niagara Falls The Ottawa and other rivers tributary to the St Lawrence have been connected with the Great Lakes by canals (*See* Canals, Great Lakes, St Lawrence River, Sault Sainte Marie, Welland Ship Canal)

The western interior of Canada is handicapped because most of its rivers drain *away* from the settled areas toward the Arctic Ocean and Hudson Bay They are used only for local traffic among the settlements on their banks The 2 635-mile Mackenzie River empties into the Arctic Ocean It is the longest river in Canada and is second only to the Mississippi Missouri system in North America (*see* Mackenzie River) The Churchill River and the Nelson Saskatchewan system flow into Hudson Bay The Yukon drains the vast Yukon Territory, a region twice as large as the British Isles (*see* Yukon River)

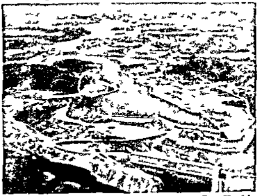
From the western mountains flow such great rivers as the Columbia and the Fraser Giant Kenney Dam on the Nechako reverses the headwaters of the Fraser into a ten-mile tunnel through the Coastal Range to the world s greatest underground power station at Kemano, B C The world s largest aluminum smelter at Kitimat B C , began using its power in 1954

Many parts of Canada are high above sea level The entire Shield is elevated, and in the east as its streams flow into the St Lawrence Valley they can be dammed to generate electric power Canada is second only to the United States in developed water power but has utilized only about one fifth of its potential power (*see* Water Power) Ontario and Quebec produce about four fifths of the total As they have no coal, their water is an important resource One of the largest projects is the Shipshaw Development on the Saguenay River in eastern Quebec In 1953 Canada and the United States agreed to joint construction of a huge power plant at the International Rapids section of the St Lawrence

"Our Lady of the Snows '

Rudyard Kipling gave Canada this beautiful name as a tribute to its white winters The northern continental climate is a handicap and an advantage The Arctic cold of the Far North discourages settlement Elsewhere, however the extremes of heat and cold the

THE GREAT SHIPSHAW POWER PROJECT



Looking up the Saguenay River, we see Shipshaw Dam No 2 in the foreground and Dam No 1 in the distance The two powerhouses have a combined capacity of 1 200 000 horsepower

rhythmic change of the seasons, help to produce a vigorous, stable, and hard-working people.

The oceans have little tempering effect on the interior of the country. On the west the Rockies cut off the moderate rain-bearing Pacific winds. As a result, the Prairie Provinces suffer great extremes of temperature. Fort Vermilion, in northern Alberta, has a recorded range of 174° F.—from −76° to 98°. In parts of Alberta and Saskatchewan semiarid conditions prevail. The east coast is swept by the cold Labrador current from the northwestern Atlantic, and by the prevailing westerly winds from across the continent. The Great Lakes moderate the weather in the southeastern part of the country.

Varying altitudes within the continent result in varying climatic conditions. The Peace River country, for example, at an elevation of 1,000 feet above sea level, is no colder than southern Alberta at 3,500 feet. Winds blowing over large land masses also affect temperatures. In the winter, warm Chinook winds blowing from the southwest across the prairies often bring a rise of 60 degrees within a few hours. Icy blasts from the North Pole, on the other hand, may drive the thermometer far below zero. Summer heat through the interior reaches 90 to 100 degrees.

Rainfall is heavy on the Pacific coast, plentiful in the east, but scanty in the western interior. The Arctic northwest has less snow than southern Quebec and the Maritime Provinces.

Plants and Animals of Canada

In a country as large as Canada, with its great variations of climate and physical environment, the range of plant life is very wide. The country may be divided into six plant regions, each with its typical animal life: Arctic, Transcontinental, Eastern, Great Lakes, Prairie, and Western.

The *Arctic* flats and the many islands that fringe the northern extremity of the continent, are treeless. The lower layers of the soil are permanently frozen, and only the surface thaws in the summer. Dwarf shrubs huddle close to the ground to escape the strong winds. Low-lying herbs with shallow roots send profuse branches over the surface. Their dense spread absorbs a maximum of the brief sunshine, and forms a protective covering of withered leaves for the seeds and wintering buds. Ferns and mosses are common. These are the "barren lands," or tundra, inhabited by musk oxen and caribou, polar bears, hares and rabbits, Arctic foxes, and wolverines.

The *Transcontinental* region below the Arctic area extends from the Yukon across the Hudson Bay country to the mouth of the Gulf of St. Lawrence. Except in the extreme northwest where the mountains reach high altitudes, the land is generally flat and often swampy, with many shallow lakes and streams. The outstanding feature is the belt of coniferous forests found everywhere except on the mountain tops of the Yukon. Typical trees are the white and black spruce, tamarack, balsam fir, jack pine, with a few such hardwoods as the aspen, balsam poplar, and white birch. Among the many shrubs are juniper, rock cranberry, the beautiful crimson swamp laurel, bearberry, and swamp red currant. The swamps, known as muskeg, consist of spongy, treeless areas, covered with sphagnum, or muskeg moss. In the forests dwell deer, moose, black bears, timber wolves, and the fur-bearing animals for which Canada is famous—fox, lynx, beaver, otter, marten, fisher, mink, and skunk. In the more open northern sections live herds of caribou.

The *Eastern* region includes eastern Ontario, Quebec, the Maritime Provinces, and Newfoundland, from the foot of James Bay southward. This is a hardwood forest zone. Some of the more important trees are yellow birch, beech, burr and red oak, white elm, sugar maple, red maple, white and black ash, and black cherry. There are also such evergreens as white and red pine, white cedar, and hemlock. Here, too, is considerable swampy open ground. Wild flowers and flowering shrubs are abundant. In the autumn this region is a flaming symphony of color. The beautiful maple is the symbol of the nation and the inspiration for a national song, 'The Maple Leaf For Ever'. In the forests live deer, moose, wolves, bears, and many of the fur-bearing animals found also farther north.

The *Great Lakes* region between Lakes Huron, Erie, and Ontario is recognized by botanists as a unique area, remarkable for the variety of its plant life. It contains nearly 300 species which occur nowhere else in Canada. Point Pelee, the most southerly part of Canada, has been made a national park to preserve its unusual flora. This is also a focal point for migratory birds which assemble at Point Pelee in huge numbers in the spring and fall.

The *Prairie* region, from the Red River Valley to the foothills of the Rocky Mountains, is for the most part treeless, except along the river valleys where cottonwoods and maples are common. In certain parts are lakes which have no outlets. They are bordered by salt marshes whose plants are typical of the seashore. Much of the prairie is dry, and its plant life is desert-like. On the plains may still be found prong-horned antelope, bison, elk, coyotes, and wolves.

The *Western* region extends from the Rocky Mountains to the Pacific coast. Because of the variations in altitude and rainfall, vegetation is varied and extremely abundant. Here are great forests of lodgepole pine, Douglas fir, white pine, Engelmann spruce, and many others. On the mountains and in the forests are mule deer, grizzly bears, pumas, bighorn sheep, and Rocky Mountain goats.

Canada's forests, plains, and barren lands are the nesting grounds of millions of song birds; hawks; geese, ducks, and other game birds. Many species, seen in the United States only during the spring and fall migrations, make their summer homes north of the border. Canada and the United States protect these birds under the Migratory Bird treaty.

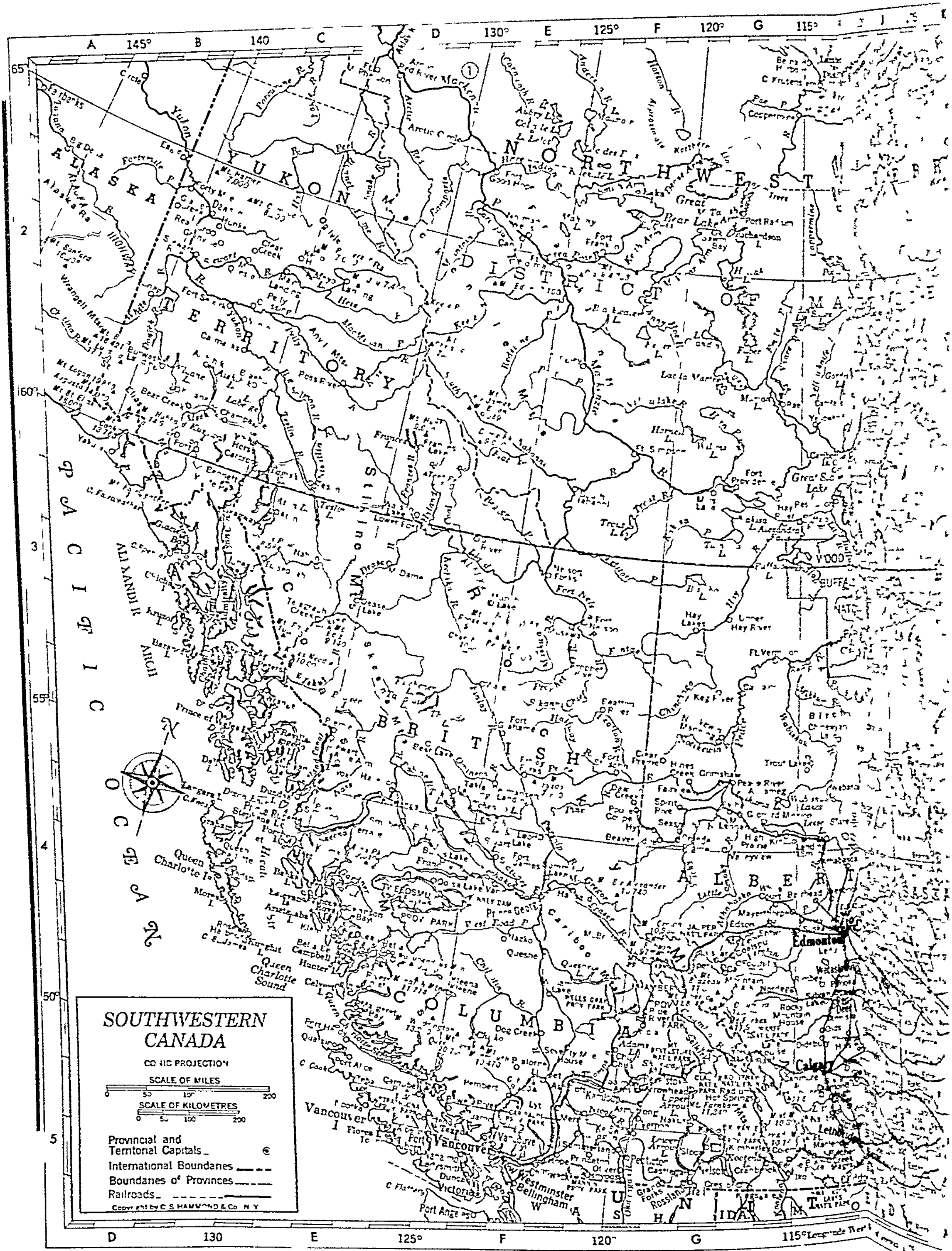
The People of Canada

About half of Canada's population is descended from British ancestors—English, Scottish, or Irish. Almost a third are French. The remainder are German, Ukrainian, Polish, Italian, Dutch, and Scandinavian.

SOUTHWESTERN CANADA*

Aberdeen (lake) N W T		L 2
Adelaide (pen) N W T		L 1
Aklavik N W T		D 1
Aishihik Yukon		C 2
Alberni B C	3 323	E 5
Alberta (mt) Alta		G 4
Alberta (province)	939 501	G 4
Alexandra (falls) N W T		G 2
Alsask Sask	209	J 4
Altona Man	1 438	L 5
Amery Man	25	M 3
Amisk (lake) Sask		K 4
Anderson (river) N W T		E 1
Angikuni (lake) N W T		L 2
Anvil (mts) Yukon		D 2
Arborfield Sask	520	K 4
Arcola Sask	614	K 5
Arctic Red River N W T		D 1
Aristazabal (island) B C		D 4
Armark (river) N W T		K 1
Armstrong B C	1 126	G 4
Artillery (lake) N W T		J 2
Assiniboia Sask	1 938	J 5
Assiniboine (mt) Alta		H 4
Assiniboine (river)		K 4
Athabasca Alta	1 068	H 4
Athabaska (lake) Sask		J 3
Athabaska (river) Alta		H 3
Atikameg Alta.		G 3
Atlin B C	500	D 3
Atlin (lake) B C		D 3
Atna Peak (mt) B C		E 4
Aubry (lake) N W Terr		E 1
Augusta (mt) Yukon		B 2
Austin (island) N W T		M 2
Aylmer (lake) N W T		J 2
Babine (lake) B C		E 4
Back (river) N W Terr		K 1
Baffin (island) N W T		P 2
Baillie (river) N W T		J 2
Baker Lake N W Terr		L 2
Banff Alta	2 357	G 4
Banks (island) B C		D 4
Banks (pen) N W Terr		J 1
Baralzon (lake) Man		L 3
Barlow (lake) N W Terr		K 2
Barrhead Alta	1,243	H 4
Barrow (cape) N W T		H 1
Bassano Alta	624	H 4
Bathurst Inlet N W T		J 1
Battle (river) Alta		H 4
Battleford Sask	1 319	J 4
Bear Lake B C		E 3
Bearcreek Yukon		C 2
Beatton River B C		F 3
Beaulieu (river) N W T		H 2
Beauséjour Man	1 376	L 4
Beauval Sask		J 3
Beaver (river) Yukon		E 2
Bell (pen) N W Terr		P 2
Bella Bella B C		F 4
Bella Coola B C	350	E 4
Belot (lake) N W Terr		E 1
Bencas (isl) N W Terr		P 2
Bennett B C		C 3
Berens (island) Man		L 4
Berens River Man	200	L 4
Bernard Harbour N W T		G 1
Bienfait Sask	794	K 5
Big Beaver Sask	100	J 5
Big River Sask	901	J 4
Big Salmon (river) Yukon		J 2
Big Sand (lake) Man		L 3
Biggar Sask	2 214	J 4
Birch (mts) Alta		H 3
Birtle Man	741	K 4
Bissett Man	250	L 4
Bistcho (lake) Alta		G 3
Black (island) Man		L 4
Black (lake) Sask		J 3
Black Diamond Alta	1,154	H 4
Blackwater (lake) N W T		F 2
Blaine Lake Sask	484	J 4
Blairmore Alta	1 933	H 5
Bloodvein (river) Man		L 4
Blue River, B C	500	G 4
Boas (river) N W Terr		N 2
Boissevain Man	1 015	L 5
Bonnet Plume (river) Yukon		D 1
Bonnyville, Alta	1 139	H 4
Bow Island Alta	653	H 5
Bowser (lake) B C		E 3
Boyd (lake) N W Terr		K 2
Braeburn Yukon		C 2
Bralorne B C	500	F 4
Brandon Man	20 598	K 5
Brazeau (mt), Alta		G 4
British Columbia (prov)	1 165 210	E 3–4
Brochet Man		K 3
Brooks Alta	1 648	H 4
Buffalo (lake) N W T		G 2
Buffalo (park) Alta		H 4
Buffalo Narrows Sask		J 3
Buffalo River, N W Terr		H 2
Burns Lake B C	801	E 4
Burnside (river) N W T		H 1
Burntwood (river) Man		L 3
Burwash Landing Yukon		C 2
Cabri Sask	466	J 4
Cadomin Alta	400	G 4
Calgary Alta	129 060	H 4
Calvert (island) B C		E 4
Camlaren N W Terr		H 2
Campbell (bay) N W Terr		K 1
Campbell (island), B C	200	E 4
Campbell (mt) Yukon		C 2
Campbell River B C	1 986	E 4
Camrose Alta	4,131	H 4
Camsell (lake) N W T		H 2
Camsell Portage Sask		J 3
Canora Sask	1 568	K 4
Cape Krusenstern N W Terr		G 1
Carberry Man	912	L 5
Carcajou Alta		G 3
Carcajou (river) N W T		F 1
Carcross Yukon	150	C 2
Cardston Alta	2 487	H 5
Carey (lake) N W Terr		K 2
Cariboo (mts)		F 4
Caribou (isl) N W Terr		P 2
Caribou (islands) N W T		H 2
Caribou (river) Man		L 3
Carlyle Sask	716	K 5
Carmacks Yukon		C 2
Carman, Man	1 867	L 5
Carnduff Sask	610	K 5
Carnwath (river) N W T		E 1
Carrot (river) Sask		K 4
Castlegar, B C	1 329	G 5
Castor Alta	798	H 4
Cedar (lake) Man		K 4
Champagne Yukon		C 2
Chantrey (inlet) N W T		L 1
Chesterfield Inlet N W T		M 2
Chilcotin (river) B C		F 4
Chilko (lake) B C		F 4
Chilliwack B C	5 663	F 5
Chinchaga (river) Alta		G 3
Chipewyan Lake, Alta		H 3
Christie (bay) N W T		J 2
Christie (mt) N W T		E 2
Chu Chua B C	77	G 4
Chuchi (lake) B C		F 3
Churchill Man	500	M 3
Churchill (lake) Sask		J 3
Churchill Peak (mt) B C		E 3
Churchill (river)		K 3
Claire (lake) Alta		H 3
Claresholm Alta	1 608	H 4
Clark (mt) N W Terr		F 2
Clear Creek Yukon		C 2
Clear Prairie Alta		G 3
Clearwater (river)		H 3
Climax Sask	293	J 5
Clinton-Colden (lake) N W Terr		J 2
Coal (river), Yukon		F 2
Coalspur Alta		G 4
Coast (mts)		E 3–4
Coats (isl) N W Terr		P 2
Cobham (river)		M 4
Coleman Alta	1 961	H 5
Columbia (mt) Alta		G 4
Columbia (river), B C		G 4
Colville (lake), N W T		E 1
Comfort (cape) N W T		P 1
Consul Sask	105	J 5
Contowoyto (lake) N W Terr		H 1
Cook (cape), B C		E 4
Cook (mt) Yukon		B 2
Cooking Lake Alta		H 4
Coppermine N W Terr		G 1
Coral Harbour N W T		P 2
Corbett (inlet) N W T		M 2
Cormorant Man		L 4
Coronation Alta	738	H 4
Coronation (gulf) N W T		H 1
Courageous (lake) N W T		H 2
Courtenay B C	2 553	F 5
Coutts Alta	350	H 5
Cowan Man		K 4
Craik Sask	549	J 4
Cranbrook B C	3 621	G 5
Cree (lake) Sask		J 3
Creston B C	1 626	G 5
Cross Lake Man		L 4
Crown (mt) Alta		G 4
Crysdale (mt) B C		F 3
Cudworth, Sask	559	J 4
Dalton Post Yukon		C 2
Daly (bay) N W Terr		N 2
Dauphin Man	6 007	K 4
Davidson Sask	870	J 4
Dawson Yukon	783	C 2
Dawson (inlet) N W T		M 2
Dawson Creek B C	3 589	F 3
Daysland Alta	475	H 4
De Gras (lake) N W T		J 2
Dease (str) N W Terr		J 1
Dease Arm (inlet) N W T		F 1
Dease Lake B C		E 3
Delaronde (lake) Sask		J 4
Delisle Sask	411	J 4
Deloraine Man	874	K 5
Devils Paw (mt) B C		D 3
Didsbury Alta	1 160	H 4
Diggee Man		M 3
Dixon Entrance (strait) B C		D 4
Dog (lake) Man		L 4
Dome Peak (mt), N W T		E 2
Donjek (river) Yukon		C 2
Dore Lake Sask		J 4
Drumheller Alta	2 601	H 4
Dubawnt (lake) N W T		K 2
Duck Lake Post Man		L 3
Duck Lake Sask	535	J 4
Duck Mountain (park) Sask		K 4
Duke of York (arch) N W Terr		H 1
Duncan B C	2 784	F 5
Dundas (island) B C		D 4
Eastend Sask	665	J 5
Echoing (river)		M 3
Edziza (mt) B C		D 3
Edmonton (cap) Alta	159 631	H 4
Edson Alta	1 956	G 4
Eduni (mt) N W Terr		E 2
Elbow, Sask	247	J 4
Elk Island (park) Alta	55	H 4
Elkhorn Man	635	K 5
Elko, B C	200	G 5
Fil (bay) N W Terr		N 2
Ellice (riv) N W Terr		K 1
Elrose Sask	491	J 4
Embarras Portage Alta		H 3
Emerson Man	884	L 5
Emile (riv), N W Terr		G 2
Empress Alta	411	H 4
Ennadai (lake) N W T		K 2
Entwistle Alta	213	G 4
Eriksdale Man	260	L 4
Eskimo Pt N W Terr		M 2
Estevan Sask	3 935	K 5
Estevan (islands) B C		E 4
Eston Sask	1 301	J 4
Eutsuk (lake) B C		E 4
Evans (str) N W Terr		P 2
Eyeberry (lake) N W T		K 2
Faber (lake) N W Terr		G 2
Fairview, Alta	929	G 3
Fairweather (mt) Yukon		C 3
Falher Alta	575	G 3
Family (lake) Man		M 4
Farnham (mt) Alta		G 4
Fernie B C	2 551	G 5
Finlay Forks, B C		F 3
Firedrake (lake), N W T		K 2
Fisher (str) N W Terr		P 2
Flat (river) N W Terr		E 2
Fletcher (lake) N W T		J 2
Flin Flon Man	9 899	K 4
Flores (island) B C		E 5
Foam Lake Sask	788	K 4
Fond du Lac Sask	35	J 3
Foothills Alta	250	G 4
Forbes (mt) Alta		G 4
Ft Chipewyan Alta		H 3
Ft Fitzgerald Alta		H 3
Ft Franklin N W Terr		F 1
Ft Good Hope N W T		E 1
Ft Grahame B C		F 3
Ft Macleod Alta	1 860	H 5
Ft McPherson N W T		D 1
Ft Nelson B C	350	F 3
Ft Norman N W Terr		E 2
Ft Providence N W T		G 2
Ft Qu appelle Sask	878	K 4
Ft Reliance N W T		J 2
Ft Resolution N W T		H 2
Ft Saint John B C	884	F 3
Ft Saint James B C	550	F 4
Ft Saskatchewan Alta	1 076	H 4
Ft Selkirk Yukon		C 2
Ft Simpson, N W Terr		F 2
Ft Smith, N W Terr	250	H 2
Ft Vermilion, Alta	350	G 3
Forty Mile Yukon		C 2
Foster (river) Sask		J 3
Fox (river) Man		M 3
Fox Valley Sask	353	J 4
Foxe (chan) N W Terr		P 1
Frances Lake Yukon		E 2
Francois (lake) B C		E 4
Franklin (lake) N W T		L 1
Franklin (mts), N W T		F 2
Fraser (river) B C		F 5
Frenchman Butte Sask	106	J 4
Frobisher (lake) Sask		J 3
Frozen (str) N W Terr		P 1
Gardner Canal (inlet) B C		E 4
Garibaldi (park), B C		F 5
Garry (lake), N W Terr		L 1
Germansen Landing B C		F 3
Gillam Man	95	M 3
Gimli Man	1 324	L 4
Glacier (park) B C		G 4
Glacier Creek Yukon		B 2
Gleichen Alta	430	H 4
Gods Lake Man	200	M 4
Gods Mercy (bay) N W Terr		N 2
Gordon (lake) N W T		H 2
Gott Peak (mt) B C		F 4
Graham (island) B C		D 4
Grand Forks B C	1 646	G 5
Grand Rapids Man	300	L 4
Grande Prairie Alta	2 664	G 3
Grandin (lake) N W T		G 2
Granville Yukon		C 2
Granville (lake) Man		L 3
Gravelbourg, Sask	1,197	J 5
Great Bear (lake) N W Terr		F 1
Greenwater (park) Sask		K 4
Grenfell, Sask	1 007	K 4
Gretna Man	608	L 5
Grimshaw, Alta	564	G 3
Grouard Mission Alta	328	G 3
Gull Lake Sask	728	J 4
Gypsumville Man	212	L 4
Halfway (river) B C		F 3
Hamber (park) B C		G 4
Hanna Alta	2 027	H 4
Hansard B C	92	F 4
Hardisty Alta	536	H 4
Harper (mt) Yukon		C 2
Hart (river) Yukon		C 1
Hartney Man	538	K 5
Hay Lakes Alta	231	G 3
Hay River N W Terr	792	G 2
Hayes (river) Man		M 3
Hazelton B C	500	E 3
Hecate (strait) B C		D 4
Heinsburg Alta	135	H 4
Herbert Sask	951	J 4
Hess (river) Yukon		D 2
High Prairie Alta	1 141	G 3
High River Alta	1 839	H 4
Hilda Alta	285	J 4
Hill Island (lake) N W T		J 2
Hines Creek Alta	212	G 3
Hood (river) N W Terr		H 1
Hope B C	1 668	F 5
Horn (riv) N W Terr		G 2
Horton (riv) N W Terr		F 1
Hottah (lake), N W T		G 1
Howard (lake) N W T		J 2
Hubbard (mt) Yukon		C 2
Hubbart (point) N W T		M 3
Hudson Bay Sask	1 115	K 4
Humboldt, Sask	2 435	J 4
Hunker Yukon		C 2
Hunt (mt) Yukon		E 2
Hunter (island) B C		E 4
Hyland (river) Yukon		E 2
Hythe Alta	342	G 3
Ile à la Crosse Sask	25	J 3
Ilford Man	97	L 3
Indian Head Sask	1 569	K 4
Indin (lake) N W Terr		G 2
Innisfail Alta	1 417	H 4
Iskut (river) B C		D 3
Island Falls Sask		K 3
Island Lake Man		M 4
Jasper Alta	1 899	G 4
Johnny Hoe (river) N W Terr		F 2
Joy (mt) Yukon		D 2
Kakisa (lake) N W T		G 2
Kamiluk (lake) N W T		K 2
Kaminak (lake) N W T		M 2
Kaminuriak (lake) N W Terr		M 2
Kamloops B C	8 099	F 4
Kamsack Sask	2 327	K 4
Kasba (lake) N W Terr		K 2
Kaslo B C	730	G 4
Kates Needle (mt), B C		D 3
Kazan (riv) N W Terr		K 2
Keele Peak (mt) N W T		E 2
Keg River Alta		G 3
Keller (lake) N W Terr		F 2
Kelliher Sask	399	K 4
Kelowna B C	8 517	G 5
Kelvington Sask	906	K 4
Kendall (cape) N W T		N 2
Kenney (dam) B C		E 4
Keno Hill Yukon		C 2
Kent (pen) N W Terr		J 1
Kerrobert, Sask	807	J 4
Kilekale (lake) N W T		F 1
Killarney Man	1 262	L 5
Kimberley B C	5 933	G 5
Kindersley Sask	1 755	J 4
King (island) B C		E 4
Kingsgate B C		G 5
Kinistino Sask	677	J 4
Kinuso Alta	238	G 3
Kississing Man	600	K 3
Kitchener (lake) B C		E 3
Kitimat B C	450	E 4
Kitwanga B C	175	E 3
Kleena Kleene B C		F 4
Klemtu B C	150	E 4
Kluane Yukon		C 2
Knee (lake), Man		M 4
Knife (river) Man		L 3
Kokanee Glacier (park) B C		G 5
Kootenay (lake) B C		G 5
Kunghit (island) B C		D 4
Kusawa (lake) Yukon		C 2
Lafleche Sask	542	J 5
La Loche Sask		J 3
La Martre (lake) N W T		G 2
La Ronge (lake), Sask		J 3
Laberge (lake) Yukon		C 2
Lac la Biche Alta	905	H 4
Lac la Ronge Sask.	100	J 3
Lacombe Alta	2 277	H 4
Ladysmith B C	2 094	F 5
Lake Louise Alta	113	G 4
Lambert (isl) N W T		H 1
Lamprey Man		M 3
Langara (island), B C		D 4
Langenburg Sask	596	K 4
Lansing Yukon		D 2
Last Mt (lake) Sask		K 4
Le Goff Alta		H 4
Leader Sask	835	J 4
Leduc Alta	1 842	H 4

*Population figures for places not listed in 1951 census courtesy of Canadian Official Railway Guide (Montreal) Other population figures from 1951 census These are the latest official census figures available



SOUTHWESTERN CANADA
CONIC PROJECTION
SCALE OF MILES
SCALE OF KILOMETRES
Provincial and Territorial Capitals
International Boundaries
Boundaries of Provinces
Railroads
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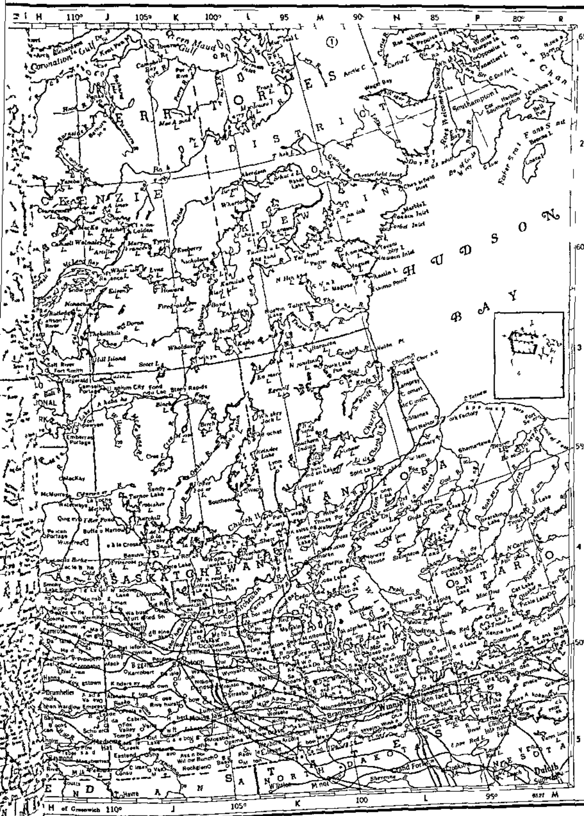
ALASKA
YUKON TERRITORY
NORTHWEST
DISTRICT OF MA
BRITISH COLUMBIA
ALBERTA
PACIFIC OCEAN
Great Bear Lake
Great Slave Lake
Edmonton
Calgary
Vancouver
Victoria
Westminster
Bellingham
Queen Charlotte Is.
Queen Charlotte Sound
Vancouver I.
Prince George
Prince Rupert
Fort Nelson
Fairbanks


110°
105°
100°
95
90
85
80°
65
60
55
50
Coronation Gulf
Queen Maud Gulf
TERRITORIES
DISTRICT
MACKENZIE
KEEWATIN
HUDSON
BAY
Chesterfield Inlet
Southampton I.
Coats I.
Fox Channel
Baffin
Churchill
Fort Smith
Fort Chipewyan
McMurray
Lake Athabaska
MANITOBA
SASKATCHEWAN
ONTARIO
The Pas
Norway House
Regina
Moose Jaw
Brandon
Winnipeg
St. Boniface
Medicine Hat
Drumheller
Empress
NORTH DAKOTA
MINNESOTA
Grand Forks
Duluth
Williston
Minot
Havre
of Greenwich

Leoville, Sask. 329 J 4
Lesser Slave (lake), Alta. H 3
Lethbridge, Alta. 22,947 H 5
Liard (river) E 3
Lillooet, B. C. 469 F 4
Little Bow (riv.), Alta. H 4
Little Buffalo (river), N.W. Terr. H 2
Little Churchill (river), Man. L 3
Little Grand Rapids, Man L 4
Little Smoky (riv.), Alta. G 4
Lloydminster, Sask 2,232 J 4
Logan (mt.), Yukon B 2
Lorillard (river), N.W. T. M 1
Low (cape), N.W. Terr. N 2
Lower Arrow (lake), B. C. G 5
Lower Post, B. C. E 3
Lucania (mt.), Yukon B 2
Lumsden, Sask. 479 J 4
Luscar, Alta. 500 G 4
Lynn Lake, Man. 2,000 K 3
Lynx (lake), N.W. Terr. J 2
Lytton, B. C 312 F 4
MacAlpine (lake), N.W. T. K 1
MacKay, Alta. H 3
MacMillan (riv.), Yukon D 2
Macdougall (lake), N.W. T. L 1
Mackay (lake), N.W. T. J 2
Mackenzie (mts.) E 2
Mackenzie (district) G 2
Mackenzie (river), N.W. T. F 2
Macklin, Sask. 531 J 4
Mafeking, Man. 278 K 4
Magrath, Alta. 1,320 H 5
Maguse R., N.W. Terr. L 2
Mahony (lake), N.W. T. E 1
Maidstone, Sask. 459 J 4
Manitoba (lake), Man. L 4
Manitoba (prov.) 776,541 L 3
Manning, Alta. *100* G 3
Manning (park), B. C. F 5
Mannville, Alta. 528 H 4
Manyberries, Alta. 130 H 5
Maple Cr., Sask. 1,638 J 5
Marble (isl.), N.W. Terr. M 2
Margaret Bay, B. C. *50* E 4
Marian (lake), N.W. T. G 2
Mary Frances (lake), N.W.T. J 2
Maunoir (lake), N.W. T. F 1
Mayerthorpe, Alta. 472 G 4
Mayo Landing, Yukon 241 C 2
McBride, B. C. 489 F 4
McClintock, Man. M 3
McCreary, Man. 365 L 4
McDame, B. C. E 3
McFarlane (riv.), Sask. J 3
McLennan, Alta. 1,074 G 3
McLeod (bay), N.W. T. H 2
McLeod (*river*), Alta. G 4
McLeod Lake, B.C. F 4
McMurray, Alta. 621 H 3
McQuesten, Yukon C 2
McTavish Arm (inlet), N.W. Terr. G 1
McVicar Arm (inlet), N.W. Terr. F 1
Meadow Lake, Sask. 1,956 J 4
Medicine Hat, Alta. 16,364 H 4
Melbourne (isl.), N.W.T. K 1
Melfort, Sask. 2,919 K 4
Melita, Man. 781 K 5
Melville, Sask. 4,458 K 4
Merritt, B. C. 1,251 F 4
Methy (lake), Sask. J 3
Mikkwa (river), Alta. H 3
Milestone, Sask. 450 K 5
Milk River, Alta. 481 H 5
Mills Lake, N.W. Terr. G 2
Minitonas, Man. 678 K 4
Minnedosa, Man. 2,085 K 4
Minto, Yukon C 2
Minton, Sask. 182 K 5
Mirror Landing (Smith), Alta. 344 H 3
Mist (mt.), Alta. G 4
Monarch (mt.), B. C. E 4
Monmouth (mt.), B. C. F 4
Montreal (isl.), N.W. T. L 1
Montreal Lake, Sask. 25 J 4
Moose (lake), Sask. J 3
Moose Jaw, Sask. 24,355 J 4
Moose Lake, Man. L 4
Moose Mountain (park), Sask. K 5
Moosomin, Sask. 1,235 K 4
Morden, Man. 1,562 L 5
Moresby (island), B. C. D 4
Morinville, Alta. 892 H 4
Morris, Man. 1,193 L 5
Mossbank, Sask. 509 J 5
Mt. Robson (pk.), Alta. G 4
Mountain Park, Alta. 400 G 4
Mt. Revelstoke (park), B. C. G 4
Muncho Lake, B. C. E 3
Mundare, Alta. 596 H 4
Muskwa, B. C. F 3
Nahlin, B. C. D 3
Nakusp, B. C. 1,750 G 4
Nanaimo, B. C. 7,196 F 5
Nanton, Alta. 934 H 4
Nass (river), B. C. E 3
Nazko, B. C. F 4
Nechako (river), B. C. F 4
Neepawa, Man. 2,895 L 4
Nejanilini (lake), Man. L 3
Nelson, B. C. 6,772 G 5
Nelson (river), Man. L 3
Nelson Forks, B. C. F 3
New Westminster, B. C. 28,639 F 5
Nicholson (lake), N.W. T. K 2
Nicola (river), B. C. F 4
Nipawin, Sask. 3,050 K 4
Nisutlin (river), Yukon D 2
Nokomis, Sask 449 J 4
Nordegg, Alta. 1,700 G 4
Norman Wells, N.W. Terr. 600 E 1
N. Battleford, Sask. 7,473 J 4
N. Henik (lake), N.W. T. L 2
N. Saskatchewan (riv.) J 4
N. Vancouver, B. C. 15,687 F 5
Northwest Terr 16,004 J 1
Norway House, Man. 1,200 L 4
Nueltin L., N.W. Terr L 2
Nutarawit (lake), N.W. T. L 2
Nuwata, N.W. Terr. K 1
O'Reilly (isl.), N.W. T L 1
Ocean Falls, B. C 2,650 E 4
Ogema, Sask. 467 K 5
Ogilvie (mts.), Yukon D 2
Okanagan (lake), B. C. F 5
Olds, Alta. 1,617 H 4
Oliver, B. C. 1,000 F 5
Ootsa Lake, B. C. 50 E 4
Opposite (isl.), N.W. T. P 1
Osoyoos, B. C. 899 F 5
Outlook, Sask. 676 J 4
Outpost Island, N.W. T H 2
Oxbow, Sask. 688 K 5
Oxford House, Man. L 3
Padlei, N.W. Terr L 2
Parsnip (river), B. C. F 3
Patterson (mt.), Yukon D 2
Peace River, Alta. 1,672 G 3
Peel (river) C 1
Pelican Portage, Alta H 3
Pelly, Sask. 361 K 4
Pelly (lake), N.W. Terr. K 1
Pelly Crossing, Yukon C 2
Pemberton, B. C. 25 F 4
Penticton, B. C. 10,548 G 5
Perdue, Sask 389 J 4
Perry R., N.W. Terr K 1
Peter Pond (lake), Sask J 3
Pigeon (river), Man. L 4
Pikwitonei, Man. 150 L 3
Pincher Cr., Alta 1,456 H 5
Pine Falls, Man 600 L 4
Pitt (island), B. C. D 4
Playgreen (lake), Man L 4
Point (lake), N.W. Terr. H 1
Ponoka, Alta. 2,574 H 4
Ponteix, Sask. 608 J 5
Poplar (river), Man. L 4
Porcher (island), B. C. D 4
Porcupine Plain, Sask. 599 K 4
Port Alberni, B. C. 7,845 E 5
Port Alice, B. C. 350 E 4
Port Hardy, B. C. 175 E 4
Port Nelson, Man. M 3
Port Radium, N.W. T. G 1
Port Simpson, B. C. 750 E 4
Portage la Prairie, Man. 8,511 L 4
Portland Canal (inlet), B. C. D 3
Pouce Coupe, B. C. 459 F 3
Powell River, B. C. 7,000 F 4
Preeceville, Sask. 746 K 4
Prelate, Sask. 585 J 4
Premier, B. C. 400 E 3
Primrose (lake), Sask. J 4
Prince Albert, Sask. 17,149 J 4
Prince George, B. C. 4,703 F 4
Prince Rupert, B. C. 8,546 D 4
Princess Royal (island), B. C. E 4
Princeton, B. C. 3,000 F 5
Prophet River, B. C. F 3
Provost, Alta. 676 H 4
Pukatawagan, Man. K 3
Quatsino, B. C. 300 E 4
Queen Bess (mt.), B. C. F 4
Queen Charlotte (isls.), B. C. 2,389 D 4
Queen Charlotte (str.), B. C. E 4
Queen Maud (gulf), N.W. T. K 1
Quesnel, B. C. 1,587 F 4
Quill (lakes), Sask. K 4
Quoich (riv.), N.W. Terr. M 2
Radium Hot Springs, B. C. 75 G 4
Radville, Sask. 973 K 5
Rae, N.W. Terr. G 2
Ramparts (river), N.W. T. D 1
Rankin (inlet), N.W. T. M 2
Rat River, N.W. Terr. H 2
Ratz (mt.), B. C. D 3
Raymond, Alta. 2,279 H 5
Readford, Yukon C 2
Red Deer, Alta. 7,575 H 4
Red River, Alta. H 3
Redcliff, Alta. 1,538 H 4
Redstone (river), N.W. T. E 2
Regina (cap), Sask. 71,319 K 4
Reindeer (island), Man. L 4
Reindeer (lake), Man. K 3
Repulse Bay, N.W. Terr. N 1
Revelstoke, B. C. 2,917 G 4
Richardson (islands), N.W. Terr. H 1
Riding Mountain (park), Man. K 4
Rimbey, Alta. 757 H 4
Riverhurst, Sask. 218 J 4
Rivers Inlet, B. C. 250 E 4
Riverton, Man. 786 L 4
Robson (mt.), Alta. G 4
Rockglen, Sask. 393 J 5
Rocky (mts.) F 3
Rocky Mountain House, Alta. 1,147 G 4
Roes Welcome (sound), N.W. Terr. N 2
Roosevelt (mt.), B. C. E 3
Rosetown, Sask. 1,865 J 4
Ross River, Yukon D 2
Rossland, B. C. 4,604 G 5
Rosthern, Sask. 1,183 J 4
Rouleau, Sask. 388 K 4
Russell, Man. 1,100 K 4
St. Boniface, Man 26,342 L 5
Saint Elias (mt.), Yukon B 2
Saint James (cape), B. C. D 4
St Martin (lake), Man. L 4
Saint Paul, Alta. 1,407 H 4
Saint Walburg, Sask. 528 J 4
Ste Rose du Lac, Man. 701 L 4
Salmon Arm, B. C. 1201 G 4
Salt River, N.W. Terr. H 2
Saltcoats, Sask. 522 K 4
Sandy Lake, Sask. J 3
Saskatchewan (prov.) 831,728 J 4
Saskatchewan (river) K 4
Saskatoon, Sask. 53,268 J 4
Sawmill Bay, N.W. Terr. G 1
Schuler, Alta. 188 H 4
Schultz (lake), N.W. T. L 2
Scott (lake), N.W. Terr. J 2
Selkirk, Man 6,218 L 4
Selkirk (mts.), B. C. G 4
Selwyn (lake), N.W. T. K 2
Seventy Mile House, B.C. 25 F 4
Sexsmith, Alta 331 G 3
Shamattawa, Man. M 3
Shaunavon, Sask. 1,625 J 5
Shellbrook, Sask 649 J 4
Sherman (inlet), N.W. T. L 1
Sherridon, Man. 1500 K 3
Shoal Lake, Man. 721 K 4
Shuswap (lake), B. C. G 4
Sikanni Chief (river), B. C. F 3
Sipiwesk (lake), Man. L 4
Sir Alexander (mt.), B. C. F 4
Sir James McBrien (mt.), N.W. Terr. E 2
Skeena (mts.), B. C. E 3
Slave (river) H 2
Slocan, B. C. 374 G 5
Smith Arm (inlet), N.W. Terr. F 1
Smith River, B. C. E 3
Smith (Mirror Landing), Alta. 344 H 3
Smithers, B. C. 1,204 E 4
Smoky (river), Alta. G 4
Smoky Lake, Alta. 491 H 4
Snag, Yukon B 2
Snake (lake), Sask. J 3
Snake (river), Yukon D 1
Snare (lake), N.W. Terr. H 2
Snow Lake, Man. 300 K 4
Snowbird (lake), N.W.T. K 2
Snowdrift, N.W. Terr. H 2
Souris, Man. 1,584 K 5
S. Indian Lake, Man. L 3
South Junction, Man. 250 L 5
South Knife (riv.), Man. L 3
S. Nahanni, N.W. Terr. F 2
S. Saskatchewan (river) J 4
Southampton (island), N.W. Terr. P 2
Southend, Sask. K 3
Southern Indian (lake), Man. L 3
Spirit River, Alta. 553 G 3
Split Lake, Man. 500 L 3
Squamish, B. C. 589 F 5
Stalin (mt.), B. C. F 3
Starnes, Man. M 3
Steep Rock, Man. 88 L 4
Steinbach, Man. 2,155 L 5
Stephens (island), B. C. D 4
Stettler, Alta. 2,442 H 4
Stevenson (lake), Man. L 4
Stewart, B. C. 283 E 3
Stewart River, Yukon C 2
Stikine (mts.) D 2-3
Stone Rapids, Sask. J 3
Strasbourg Sta., Sask. 505 K 4
Strathcona (park), B. C. E 5
Strathmore, Alta. *704* H 4
Stuart (lake), B. C. F 4
Stupendous (mt.), B. C. E 4
Sturges (isls.), N.W. Terr. P 1
Sullivan (lake), Alta. H 4
Summerland, B. C. 3,000 F 5
Summit Lake, B. C. F 4
Sundown, Man. 600 L 5
Sutherland, Sask. 1,329 J 4
Swan River, Man 2,290 K 4
Swanson Bay, B. C. E 4
Swift Current, Sask. 7,458 J 4
Sylvan Lake, Alta. 985 H 4
Taber, Alta. 3,042 H 5
Tagish (lake), Yukon D 2
Takla Landing, B. C. E 3
Taltson River, N.W.T. H 2
Tathlina (lake), N.W. T. G 2
Tatnam (cape), Man. M 3
Tavani, N.W. Terr. M 2
Tazin (lake), Sask. J 3
Tchentlo (lake), B. C. F 3
Tehek (lake), N.W. T. L 1
Telegraph Creek, B. C. 75 D 3
Tent Peak (mt.), Yukon E 3
Terrace, B. C. 961 E 4
Teslin, Yukon D 2
Teulon, Man. 645 L 4
Texada (island), B. C. F 5
Tha-Anne (river), N.W. T. L 2
The Pas, Man. 3,376 K 4
The Kulthill (lake), N.W. Terr. J 2
Thelon (river), N.W. T. K 2
Thicket Portage, Man. L 3
Thompson (river), B. C. F 4
Three Hills, Alta. 1,026 H 4
Thutade (lake), B. C. E 3
Tisdale, Sask. 2,141 K 4
Tofino, B. C. 302 E 5
Tompkins, Sask. 388 J 4
Tornado (mt.), Alta. G 5
Trail, B. C. 11,430 G 5
Transcona, Man. 6,752 L 5
Tree (river), N.W. Terr. H 1
Treherne, Man. 589 L 5
Trout (lake), N.W. Terr. F 2
Trout Lake, Alta. G 3
Tulemalu (lake), N.W. T. L 2
Tulsequah, B. C. D 3
Turnor (lake), Sask. J 3
Turtleford, Sask. 280 J 4
Tweedsmuir (pk.), B. C. E 4
Tyrrell (lake), N.W. T. J 2
Unity, Sask. 1,248 J 4
Upper Arrow (lake), B. C. G 4
Upper Foster (lake), Sask. K 3
Upper Hay River, Alta. G 3
Uranium City, Sask. 1,900 J 3
Utikuma (lake), Alta. G 3
Val Marie, Sask. 357 J 5
Valleyview, Alta. G 4
Vancouver, B. C. 344,833 F 5
Vancouver (island), B. C. E 5
Vancouver (mt.), Yukon C 2
Vanderhoof, B. C. 644 F 4
Vansittart (isl.), N.W. T. P 1
Vegreville, Alta. 2,223 H 4
Verlo, Sask. 134 J 4
Vermilion, Alta. 1,982 H 4
Vernon, B. C. 7,822 G 4
Victoria (cap.), B. C. 51,331 F 5
Victoria Beach, Man. L 4
Virden, Man. 1,746 K 5
Vulcan, Alta. 1040 H 4
Wabasca, Alta. H 3
Wabiskaw (lakes), Alta. H 3
Wabiskaw (river), Alta. G 3
Wabowden, Man. 88 L 3
Waddington (mt.), B. C. E 4
Wadena, Sask. 1,081 K 4
Wager Bay, N.W. Terr. M 1
Wainwright, Alta. 1,996 H 4
Wakaw, Sask. 766 J 4
Walmsley (lake), N.W. T. J 2
Wanless, Man. 100 K 4
Wapawekka (lake), Sask. K 4
Wapus, Sask. K 3
Wardlow, Alta. H 4
Ware, B. C. 75 E 3
Waterhen (lake), Man. L 4
Waterton Lakes (park), Alta. H 5
Waterways, Alta. 400 H 3
Watrous, Sask. 1,228 J 4
Watson, Sask. 718 K 4
Watson Lake, Yukon 100 E 2
Wekusko, Man. 150 L 4
Wells Gray (park), B. C. F 4
Westlock, Alta. 1,111 H 4
Wetaskiwin, Alta. 3,824 H 4
Weyburn, Sask. 7,148 K 5
Whiskey Jack (lake), Man. K 3
White Court, Alta. 130 G 4
White Horse, (cap.) Yukon 2,594 C 2
White Pass, B. C. C 3
Whitefish (lake), N.W T. J 2
Whiteshell (park), Man. L 4
Wholdaia (lake), N.W. T. K 2
Wilkie, Sask. 1,580 J 4
Williams Lake, B. C. 913 F 4
Willow Bunch, Sask. 613 J 5
Willowlake (river), N.W. Terr. F 2
Winefred (lake), Alta. H 3
Winkler, Man. 1,331 L 5
Winnipeg (cap.), Man. 235,710 L 5
Winnipeg (lake), Man. L 4
Winnipegosis, Man. 924 K 4
Winnipegosis, (lake), Man. L 4
Wollaston (lake), Sask. K 3
Wolseley, Sask. 983 K 4
Wood Buffalo (park) H 3
Wrigley, N.W. Terr. F 2
Wynyard, Sask. 1,326 K 4
Yellow Grass, Sask. 457 K 5
Yellowknife, N.W.Terr. 2,724 H 2
Yoho (park), B. C. G 4
York Factory, Man. M 3
Yorkton, Sask. 7,074 K 4
Youngstown, Alta. 352 H 4
Yukon (territory) 9,096 D 2
Yukon (river), Yukon C 2
Zeballos, B. C. 650 E 4

Canada has about 150 000 Indians and 10 000 Eskimos Chinese and Japanese total 54 000 Concentrated on the west coast before the second World War the Japanese are now scattered throughout the country

The French Canadians are devout Roman Catholics bound together by close ties of religion tradition and their French heritage In many respects they have kept the beliefs and the way of life of their colonial ancestors They have changed less than their countrymen across the sea and today have little in common with them Their language their faith their schools even their own civil law are guaranteed to them under the Quebec Act of 1774 Nevertheless they are an integral part of the nation and strongly nationalistic Canada is bilingual by law and all government publications are printed in both French and English

The French Canadians were the original Canadians Samuel de Champlain founded the city of Quebec in 1608 12 years before the Pilgrims landed on Plymouth Rock The struggling colony s hold was weak and in 1759 Quebec fell before the daring attack by the English general James Wolfe Four years later the colony was ceded by France to Britain (*see* French and Indian War)

From that time on the French Canadians were cut off from their mother country and there was virtually no additional immigration from France to swell their numbers Yet they have multiplied astonishingly From the 55 009 persons recorded in the census of 1754 they have increased in less than 200 years to 4 319 000 They are still increasing faster than any other group in Canada Families of 10 to 14 children are typical They comprise the great majority of the population of the Province of Quebec and about two fifths of New Brunswick Of the 1 021 520 people in the city of Montreal two thirds are French

QUEBEC HANDICRAFTS

A French Canadian woman is weaving an arrow sash In the background is a hand loom still found in many French homes Woven blankets and rugs from Quebec hooked rugs, handmade lace and wood carvings are widely admired

Soon after the close of the American Revolution Canada received a large immigration from the south The United Empire Loyalists were citizens of the 13 American Colonies who remained loyal to the British government during the Revolution Between 1783 and 1784 about 40 000 of them migrated across the border to become the pioneer settlers in New Brunswick and southern Ontario Unlike the French this nucleus of British subjects was soon joined by newcomers from England Scotland and Ireland Today they number almost 7 million

The Prairie Provinces were settled in the early years of the 20th century by farmers from eastern Canada northern and central Europe and the United States Since 1913 Canada has lost almost as many people by emigration to the United States as it has gained by immigration from abroad The population is now about three fifths urban

The Roman Catholic Church claims 43 per cent of the people Of the Protestants 20 per cent belong to the United Church and 15 per cent to the Anglican Church or Church of England

Canadian citizenship was not clearly established until Jan 1 1947 Until then Canadians had been ' British subjects On that date all native-born Canadians became Canadian citizens

Railroads Bind the Nation

In a country of vast distances and few people railroad building is enormously expensive Yet Canada ranks third in railroad mileage Only the United States and Russia have a larger mileage

The development of the country was impossible until lines of steel bound together its widely separated parts When the fathers of confederation in 1867 welded eastern Canada into a dominion they had to agree to complete the Intercolonial Railway from Halifax to Montreal This is still the only road wholly within Canadian territory between the Maritime Provinces and the St Lawrence Valley

British Columbia entered the Dominion in 1871 on condition that a transcontinental railroad be started to the Pacific coast within two years The last spike of the Canadian Pacific Railway was driven on Nov 7 1885 Two other transcontinental railroads followed—the Grand Trunk Pacific and the Canadian Northern The three competing roads expected immigration to fill the thinly settled prairies and provide a profitable traffic The first World War stopped both immigration and the flow of new capital The two newer roads failed to meet the payments on their bonds and the government was forced to take over their control They were consolidated into the Canadian National system in January 1923 Only the Canadian Pacific and several short lines (less than half the total mileage) remain in private ownership

The Hudson Bay Railroad from Le Pas in Manitoba to Churchill on Hudson Bay was completed by the government in 1931 to give midwestern Canada a short route for wheat shipments to Europe The province of Ontario owns and operates the Ontario Northland Railway from North Bay to Moosonee on James Bay In Quebec the line to the iron mines at Burnt Creek is farthest north On the western prairies the end of steel is at Fort McMurray Alta

Modern Highway Building

Canada has about 200 000 miles of surfaced roads and another 400 000 miles of other roads providing fast and safe travel for its approximately 3 million motor vehicles The first transcontinental road

LAYING A CORDUROY ROAD OVER MUSKEG

The difficulties of road building in northern Canada are apparent in this picture of the Alaska Highway (formerly Alcan) under construction. After the forest has been cleared, a corduroy road is laid over the swampy, decayed vegetable matter known as muskeg. A corduroy road is a blanket of tree trunks covered with earth and moss. Later it is surfaced with gravel. Even in summer, ice lies a few feet below the surface. In spring, melting snow and ice make a swamp on each side of the road.

known as the Trans-Canada Highway, was sanctioned in 1949. This joint federal-provincial project will, when completed, run 5,000 miles from Nova Scotia on the Atlantic coast to Vancouver on the Pacific.

Even more spectacular was the construction of the 1,523-mile Alaska Highway (formerly Alcan) between March and November 1942. This road was hewn out of the wilderness to provide a land route between Alaska and the United States. It extends southward from Fairbanks, Alaska, through White Horse, Yukon Territory, and Fort Nelson in northern British Columbia, to Dawson Creek on the Peace River, where it strikes an older road to Edmonton. A string of military airfields parallels the road. Scheduled bus lines operate over it throughout the year. In 1943 a new road was built between Peace River, Alta., and Fort Providence on Great Slave Lake.

Development of Air Transport

The discovery of crude oil at Fort Norman on the Mackenzie River in 1921 led to the first large-scale attempt to establish air transportation in the Far North. Canada now carries more air freight than any other country in the world—chiefly minerals, and machinery and supplies for the mines. Airplanes are used also in prospecting for new mines and in forest and fishery patrol work. The famous Royal Canadian Mounted Police today do more of their work by airplane than on horseback. The many "bush" lines of the northwest have been consolidated into the Canadian Pacific Air Lines. This airline also has international routes from Vancouver to the Orient and Australia.

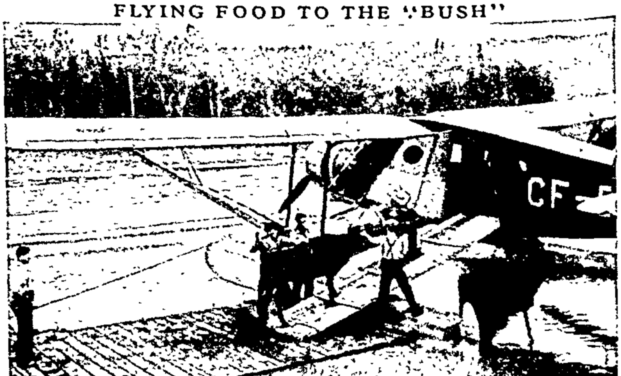
Southern Canada, with its railroads and highways, developed aviation facilities more slowly than the north. In 1938 Trans-Canada Air Lines was completed from Halifax to Vancouver and north to Edmonton. It operates coast to coast, across the Atlantic, and to the United States and the Caribbean.

During World War II Canada was the base for the British Commonwealth Air Training Plan. Thousands of pilots trained in Canada and played an important part in the war. They comprised a large body of skilled fliers for postwar commercial aviation. Canada's air lanes are also important to the United States. During the war the two countries co-operated in building airports in the Far North. Planes traveling between the United States and Europe use the airport at Gander, Nfld., under the terms of a pact giving Canada certain routes across United States territory. At Churchill, on Hudson Bay, the two countries maintain a large military airport.

Varied Agriculture and Farming Regions

Agriculture once employed more people than any other industry, but it is now second to manufacturing both in number of workers and in total value of output. Only a small portion of the land is used for crop production. About 550,000 square miles, less than one sixth of the area of the country, has agricultural possibilities. Considerably less than one half of this area is cultivated.

FLYING FOOD TO THE "BUSH"



Shoving a reluctant cow aboard an airplane requires the talents of four men. This fresh beef on the hoof will be flown to prospectors in the "bush"—the remote wilds of the Far North.

The long-settled eastern part of the country is devoted to mixed farming—cereals, cattle, dairy products, fruit, and vegetables

The French farmer of the St Lawrence River valley is a peasant in the finest original sense of the word —one who lives close to the land The purpose of his life is not to get rich, but to cultivate the soil and pass on the good acres to his sons He has little concern for world markets His large family consumes much of what the farm produces The small surplus is sold in the near by cities In good times the *habitant,* as he is called, is not so prosperous as his American and English neighbors But when depression comes he is not so poor It is the French, with their unexcelled capacity for hard work who are pushing farther north onto the thin lands of the Shield, slowly extending the farming area of Canada

APPLE ORCHARDS OF NOVA SCOTIA

The beautiful and fertile Annapolis Valley in Nova Scotia is famous for its apples which it exports to such distant lands as South Africa and South America This orchard lies along a cove which opens into the Bay of Fundy

The Scotch English farmers of Ontario and the Maritime Provinces are more specialized than the French and more dependent on export markets Dairying and stock raising are important They have made Canada one of the world s largest exporters of cheese Canadian bacon and ham, eggs, butter, and evaporated milk are shipped to Great Britain in growing quantities Fruits are exported to Great Britain, South America, and South Africa The most extensive fruit-growing areas are the Annapolis Valley in Nova Scotia, and southeastern Ontario between the Great Lakes Apples lead in value Peaches and grapes, tobacco and sugar beets, maple sugar and syrup, and flax are also important products

Across the continent in British Columbia, between the Coast Range and the Rocky Mountains are the fertile Fraser and Okanagan valleys They are famous for their fruits and vegetables

On the prairies conditions are ideal for growing hard spring wheat Marquis hybrid once used throughout Canada and the American West was developed by a Canadian botanist, *Sir Charles Saunders (see* Wheat) During World War I the wheat acreage expanded by 7 million acres The small population could not consume the production and Canada became the world s largest exporter at one time supplying nearly half the world s requirements

When crops are large and foreign markets eager to buy the Prairie farmer prospers But in the drought years of 1934 1935 and 1936 the grain shriveled in the fields In the years that followed European countries were raising *their own wheat in preparation for* war while Canadian wheat piled up in grain elevators World War II left Great Britain the sole buyer of a surplus which in 1941 was 450 million bushels The average income of the Saskatchewan farmer fell from $1 614 in 1928 to $141 in 1937 The eastern farmer can live off his land the western farmer is at the mercy of weather and world trade After the war Great Britain agreed to buy from Canada 140 to 160 million bushels annually during 1946–50 at a fixed price Canada signed the International Wheat Agreement for stabilizing world wheat prices in 1949 It renewed its *membership in 1953 for three years although Great* Britain did not continue in the agreement

The government has urged the Prairie farmers to diversify their crops and they are now less dependent on wheat oats and other grains Livestock raising has increased in the Prairie Provinces

CATTLE ROUND-UP IN ALBERTA

This herd of cattle is being driven across the Milk River in southern Alberta to summer pasture in the foothills of the Rocky Mountains Alberta is one of the leading stock raising provinces in Canada

THE VARIED SURFACE OF CANADA, A LAND OF OPPORTUNITY

North America frays out to the north into a tangle of islands, straits, and fiords. Hudson Bay cuts deeply into the continent. Bordering the Pacific Ocean are mountain ranges. The vast realm of Canada is nearly equal in area to all of Europe.

Canada has vast resources, yet it is a leader in conservation. It is spending large sums on reclamation and irrigation projects, principally in the Prairie Provinces and in British Columbia. The largest, the St. Mary-Milk River development in Alberta, will water thousands of acres. The adjacent Bow River project is another large irrigation scheme.

The Canadian agricultural co-operatives and credit unions are among the largest in the world. They operate grain elevators, purchase flour, lumber, coal, fuel oil, and all kinds of farm machinery and supplies for their members. Wheat pools were formed in 1923. The farmers delivered all their grain to the pools to be marketed by a central sales agency. The pools ran into financial difficulties during the depression years and the federal government was forced to come to their assistance. In 1935 their functions were assumed by the Canadian Wheat Board. The Board purchases wheat from the farmers at a fixed price and sells it in the international market.

Other Natural Resources

Canadian fisheries, furs, timber, and minerals attracted the first adventurers and settlers. They still provide employment for a large proportion of the working population and furnish the raw materials for the rapidly growing manufacturing industries.

Fisheries. The cold, shallow waters off the north Atlantic coast, with their many undersurface plateaus, or "banks," are among the world's richest fishing grounds. The cod fisheries of the Grand Banks were discovered by John Cabot in 1497. Before 1502 fleets of French, Spanish, and Portuguese boats were crossing the ocean each year to fish on the Banks. At first they erected temporary shelters on the shore. There they salted and dried the catch and at the end of the summer season returned with it to Europe. When they discovered that the inshore fisheries were as plentiful as those of the deep sea and far less dangerous, they began to stay all winter. The first permanent settlements were fishing villages.

The inshore waters, controlled by the government, cover 15,000 square miles. The North Atlantic grounds, including the Bay of Fundy and the Gulf of St. Lawrence, cover 215,000 square miles. Lunenburg, center of the deep-sea fisheries, has the world's largest fleet of fishing schooners. But every coastal village of the Maritime Provinces and Newfoundland has fishing vessels, canneries, and drying sheds.

The Pacific coast has rich salmon fisheries. The fresh waters of the interior are valuable for their commercial fisheries and as an attraction to sportsmen.

The most valuable species are the Pacific salmon, the Atlantic lobsters, herring, cod, halibut, whitefish, and sardines. British Columbia leads the provinces with about 40 per cent of the value of Canadian fisheries; Nova Scotia is second with 20 per cent; Newfoundland is third with about 15 per cent; and New Brunswick is fourth with about 10 per cent.

Only a small part of the catch can be consumed at home. From 60 to 70 per cent is exported. In 1952 the United States took about three fourths. Great Britain was a prime market until dollar shortages reduced its buying power. *The salmon canneries on the west coast are* the most valuable of the many canning and curing plants.

Furs The early French fishermen also traded in furs. Their large profits soon attracted adventurers who came to the New World for quick wealth. As the Spanish overran South and Central America in search of gold, so the French traders and trappers explored the heart of North America for furs (*see* Furs and Fur Trade). Beaver pelts long served as currency and the beaver occupies a place of honor on the Canadian coat of arms. So great was the destruction of these animals that they were threatened with extinction in eastern Canada by the 20th century. The writer and lecturer Grey Owl became their champion and educated the public to protect them.

Advancing civilization has driven the fur bearing animals far to the north and greatly reduced their numbers, but northern Canada is still one of the world's greatest sources of furs. Trapping and hunting are the chief occupations of the Indians and Eskimos. The Hudson's Bay Company has enjoyed a virtual monopoly of the northern fur trade for nearly 300 years (*see* Hudson's Bay Company). Its *forts are the remotest out*posts of white civilization in the far north. In the summer the trappers bring their furs by canoe to these trading posts. Many remain during the summer to work for the Company, returning with winter to the deep forests. Airplanes are now bringing furs out of the most inaccessible regions. Montreal holds the largest *auctions*. London and New York are the leading buyers.

CANADA'S OLDEST INDUSTRIES

The top picture shows Indians with fox furs at a trading post at Yellowknife. They will take payment partly in cash and partly in supplies. The bottom picture shows a salmon cannery at Prince Rupert, British Columbia.

Fur farming is growing rapidly in importance. In 1921 it accounted for only 3 per cent of the total value of raw fur production in Canada. By 1938 it had increased to 43 per cent, by 1951, 36 per cent. A large part of all *silver fox and mink pelts* produced come from fur farms. The federal Department of Agriculture maintains an experimental fur farm on Prince Edward Island.

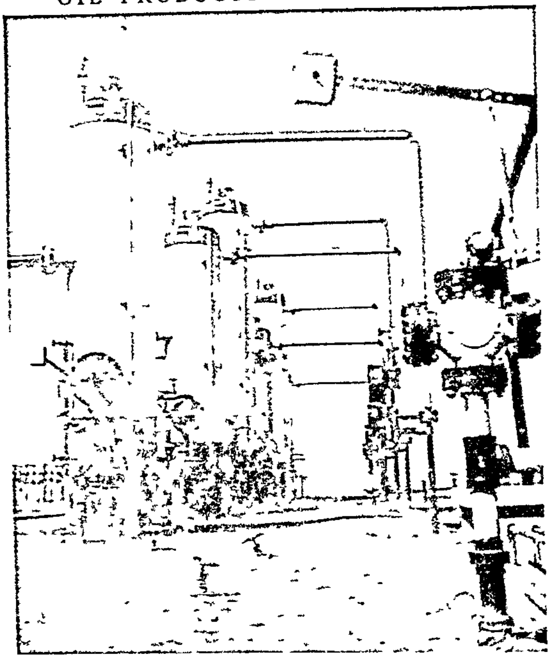
Timber Timber ranks with fish and furs as one of Canada's earliest resources to be developed.

Forests cover 35 per cent of the land area. Three-fourths of the trees are conifers or softwoods, from which comes 95 per cent of the commercial cut. Douglas fir from British Columbia, spruce, hemlock, white pine, cedar, and balsam fir are the most valuable species. Except in the Maritime Provinces, 90 per cent of the timber lands are Crown property. As new regions are opened up, the land suitable only for forest is withdrawn from public sale and set aside by the government for timber production. The lumber companies are granted cutting rights only. The federal Forest Service maintains six forest experiment stations.

Minerals Canada is one of the richest nations in minerals. In 1953 it ranked first in nickel and asbestos, second in platinum, gold, zinc, cadmium, aluminum, and perhaps uranium, third in cobalt and silver, fourth in copper and lead. Ontario leads with one third the value of the nation's production. In Toronto is the world's largest mining exchange.

During World War II vital materials never mined before were developed to meet war needs. Among these were mercury, tungsten, chromium, molybdenum, and tin. Most of the smelting and refining is done in Canada. After the war many existing ore deposits had record outputs and numerous ore bodies were discovered.

OIL PRODUCTION IN ALBERTA



The oil fields around Edmonton, Alta., opened in 1947, are among the largest in North America. By 1953 pipelines carried their oil east to Sarnia, Ont., and west to Vancouver, B. C.

The Sudbury mines of Ontario yield about 90 per cent of the world's nickel and half its platinum. A large nickel-copper-cobalt mine was opened at Lynn Lake in northern Manitoba in 1952.

Quebec produces almost all of Canada's asbestos. Gold is Canada's most valuable mineral. It comes from Ontario deposits at Porcupine, Red Lake, and Kirkland Lake; from Noranda in western Quebec; from the Flin Flon mine on the Manitoba-Saskatchewan boundary; and from Yellowstone in the Northwest Territories.

British Columbia produces most of the nation's lead and zinc, principally from the Sullivan mine at Kimberley. The largest ore smelter in the Commonwealth is at Trail. A giant lead-zinc-copper deposit was found near Bathurst in New Brunswick in 1953.

Before 1939 Canada imported most of its aluminum. At the end of World War II the reduction plant at Arvida on the Saguenay in Quebec had a capacity greater than the entire world's production. An even larger smelter began operation in 1939 at Kitimat, B. C. With plentiful hydroelectric power, Canada imports aluminum ore, processes it, and then exports most of it.

At Great Bear Lake is the world's greatest source of radium and uranium and production from this region greatly reduced their world price. This was the source of the uranium used in the United States in making the atomic bomb in 1945. A possibly even larger uranium deposit at Beaverlodge Lake in northwestern Saskatchewan was discovered in 1951.

Quebec has the largest deposit of ilmenite. the ore of titanium, at Allard Lake, 400 miles northeast of Quebec City. A railroad from Havre St. Pierre on the Gulf of St. Lawrence to the deposits was completed in 1950. The ore is shipped to a smelter at Sorel.

Canada has experienced an oil boom since the discovery of the Leduc field near Edmonton, Alta., in 1947. Redwater, Leduc-Woodbend, Bonnie Glen, and other large fields in Alberta and Saskatchewan were later opened. A 1,126-mile pipeline carried oil from Edmonton to Superior, Wis., by 1950. It was extended 635 miles to Sarnia, Ont., in 1953. In the same year a 721-mile pipeline was completed from Edmonton to Vancouver, B. C. The oil sands at Fort McMurray on the Athabaska River in northern Alberta are the greatest known oil reserves on earth (see Alberta).

Far to the north in the District of Mackenzie is the Norman Wells oil field. It was producing about 1920, but it was brought into large-scale production during World War II when the United States Army built the 1,600-mile Canol pipeline to a new refinery at White Horse, Yukon Territory. Wells are also producing in southeastern Ontario and in New Brunswick.

Pipelines for natural gas are planned from Alberta, British Columbia, and Saskatchewan to the Pacific west coast and to eastern Canada.

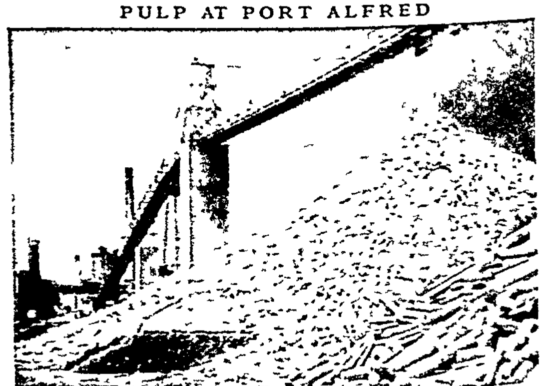
Alberta, British Columbia, and Nova Scotia have large coal reserves, but they are located 1,000 to 2,000 miles from the industrial coal-using districts of Ontario and Quebec. These provinces find it cheaper to import their coal from the United States.

Great deposits of iron beneath Steep Rock Lake in northwestern Ontario were brought into production in 1944. On the Quebec-Labrador border is an iron deposit larger than the Mesabi Range. A 360-mile railroad was opened in 1954 from Seven Islands on the Gulf of St. Lawrence to Knob Lake and Burnt Creek.

Tremendous Growth of Industry

Modern industry received its start in the early 20th century when the railroads opened up the western prairies and increased the demand for manufactured goods. World War I resulted in greater variety of products and more industrial efficiency. Many articles that had been imported were made at home. During

PULP AT PORT ALFRED



This great mound of peeled logs at Port Alfred, Que., on the Saguenay River, will be ground into pulp to make paper. Quebec and Ontario are the leading provinces in pulp and paper production, while Canada is the foremost producing country.

and after World War II Canada made its greatest industrial progress It is now an important industrial nation of the world Manufacturing today exceeds agriculture in the number of people employed

In 1939–50 the gross value of manufacturing multiplied four times Steel production more than doubled The chemical nonferrous metals shipbuilding petroleum and airplane industries greatly expanded

About 80 per cent of the manufacturing is carried on in the parts of Ontario and Quebec that lie between the Great Lakes and the St Lawrence Ontario accounts for about 50 per cent Quebec 30 per cent Here lives the bulk of Canada s industrial man power Close by are such raw materials as timber and minerals water power and large markets in the United States The vicinity of Sarnia in western Ontario is called Chemical Valley for its oil refining and other chemical plants In 1952 a large jet engine plant opened at Malton Ont Canada is a leading producer of military and commercial jet airplanes

Canadian manufacturing falls into three groups First and most valuable are those processing the raw materials of the country for export such as pulp and paper A second group of industries produces goods for a large domestic market Its raw materials are imported Such products include textiles rubber goods and sugar The third group consists of branches of United States industries such as those making trucks and automobiles agricultural implements and electrical apparatus They are set up in Canada in order to reach the Canadian market without paying tariffs and to export to other parts of the British Commonwealth under preferential trade agreements

In 1950 the paper and pulp industry led in the gross value of products Other leading industries are slaughtering and meat packing motor vehicles nonferrous metal smelting and refining petroleum products sawmills primary iron and steel butter and cheese cotton yarn and cloth and flour mills

Dependence on International Trade

Canada produces far more than it can consume The wheat crop is 5 times consumption paper production 10 times, and nonferrous metal output 20 times Canada exports more newsprint paper than any other country The United States market absorbs about 90 per cent of the production To the United States also goes 80 per cent of Canada s pulp and 99 per cent of its pulpwood Canada is among the world s leading exporters of bacon and ham butter and cheese flour and feed products and fish Canada however must import such essentials as rubber tin tropical fruits fibers sugar coffee and much coal and machinery

Canada s very existence depends on a world prepared to buy its goods and to sell it what it needs With only one half of one per cent of the world s population, Canada ranked fifth in international trade before World War II fourth in exports and eighth in imports At the close of the war it was the third exporter in the world in 1951 it ranked fourth About one third of the country s national income is dependent on foreign trade as compared with 8 to 10 per cent in the United States When world markets are disturbed by *depression and war Canada suffers more severely than* nations that are more nearly self sufficient

The United States and Great Britain are Canada s two best customers Before World War II exports were equally divided between the two In 1953 about 59 per cent of Canada's exports went to the United States and only 17 per cent to Great Britain About 74 per cent of imports came from the United States and 10 per cent from Great Britain

Close Relations with United States

The long unfortified boundary between Canada and its nearest neighbor symbolizes their friendly relations Since the War of 1812 they have worked out problems through neutral commissions and boards of arbitration In 1817 Charles Bagot British minister to Washington and Richard Rush United States secretary of state signed the Rush Bagot Agreement demilitarizing the Great Lakes (*see* Great Lakes) It stipulated that no warships were to be built on the lakes A few armed vessels enforce revenue laws The International Joint Commission formed in 1909, settles any controversy over boundary affairs

SOME NEW WAR BORN INDUSTRIES OF CANADA

Aluminum is being pressed out into tubes for aircraft construction Bauxite ore is shipped from British Guiana to Arvida Que where power from the Shipshaw dams smelts it.

A workman is holding a lump of optical glass which will be made into fine lenses This is one of the many products Canada formerly had to import.

Synthetic rubber is made at Sarnia Ont Here bales are being wrapped for shipment The rubber s principal use is in tires and tubes Much rubber is exported

The International Boundary Commission defines, marks, and maintains the boundary line between the United States and Canada and between Alaska and Canada. Several fisheries commissions handle problems arising from common use of coastal and Great Lakes waters for salmon, halibut, and other fishing.

The Permanent Joint Board on Defense was created under threat of invasion by enemy forces in August 1940. Prime Minister William Lyon Mackenzie King and President Franklin D. Roosevelt signed the agreement binding their countries permanently in joint defense of North America. Their meeting at Ogdensburg, N. Y., scene of several bloody border raids during the War of 1812, was historic. This was the first military agreement ever signed by Canada with a country outside the British Commonwealth of Nations and the first such agreement ever signed by the United States.

A PROSPECTOR FILES HIS CLAIMS

A Canadian "mountie" acts as witness as a prospector files his mining claims. Later the "mountie" will check the location and see that the prospector's interests are protected.

Several joint economic committees work on certain common problems. One of their most interesting studies is the North Pacific Planning Project, which covers northern British Columbia, Yukon Territory, and Alaska. Its immediate object is "to gather basic information on the region and to develop . . . proposals for Canadian-United States economic co-operation in the development of resources, the improvement of standards of living, settlement, and other undertakings."

Canadian and American scientists in 1944 drew up a plan for an international Arctic Institute of North America, which is undertaking systematic polar research. "Good neighbor" relations are furthered by the joint Canada-United States Committee on Education, sponsored by the American Council on Education. Its purpose is to strengthen mutual respect and understanding.

Education and the Arts

Public education is similar to that in the United States, with eight years of elementary and four of secondary training (five in Ontario). It is compulsory in the lower grades, and literacy for the country as a whole is very high (95.74 per cent). Schools are under the authority of the provincial governments. They are financed by local taxing districts, assisted by provincial grants. Provision is made in each province, except Manitoba, for tax-supported Catholic schools.

Vocational and technical schools have been established with the assistance of federal grants. Seven of the provinces support universities, corresponding to the state universities in the United States. These are New Brunswick, Manitoba, Saskatchewan, Alberta, British Columbia, Newfoundland (Memorial University), and Ontario (University of Toronto). Four other universities are supported by provincial funds—Dalhousie (Halifax), McGill (Montreal), Queen's (Kingston), and Western Ontario (London). Outstanding among the Roman Catholic French universities are St. Francis Xavier (Antigonish, N. S.), for training in co-operatives, Laval (Quebec), and Montreal. King's College, (Halifax), founded in 1789 at Windsor, is the oldest school of higher education.

Public libraries have developed in close collaboration with the schools. (For an account of Canadian libraries, *see* Libraries.)

The National Research Council, founded in 1924, operates scientific research laboratories for investigating industrial and defense problems. It also co-ordinates the work of other research laboratories in Canada. The Council directed the Chalk River atomic energy plant, about 95 miles northwest of Ottawa, from 1947 to 1952. A new Crown company, Atomic Energy of Canada, Ltd., now operates the project. Its program is devoted to research and to the production of isotopes for peacetime uses. Canadian scientists helped develop the atomic bomb.

The Banting Research Foundation, named for the codiscoverer of insulin, makes grants to workers in medical research (*see* Banting and Best).

A vigorous body of literature is developing (*see* Canadian Literature). The press follows the pattern of United States journalism, although on the whole it is more conservative. Tabloids have never been successful; and lurid, sensational dailies are rare. The ablest and best-known editor in the country was John W. Dafoe, associated with the *Winnipeg Free Press* 1901–44. For nearly half a century he influenced Canadian thought. It has been said of him that he was "a last rugged relic of the days of personal journalism," equal in stature to such editors as Greeley, Dana, and Watterson in the United States.

In painting, Canadians have won international recognition only since World War I. Of the earlier artists, few are important. Paul Kane (1810–71) portrayed Indian life. His work is of greater historical than artistic interest. Cornelius Krieghoff (1812–72) was called the "Hogarth of Canada," although his studies of rural life in the lower St. Lawrence are hardly comparable with those of that great artist.

After Confederation, appreciation of art was fostered by the founding of the Ontario Society of Artists (1872), forerunner of the Royal Canadian Academy, and the Montreal Art Association (1875). One

A SCHOOL CAR IN NORTHERN ONTARIO

In sparsely settled northern Ontario a Canadian National railroad car serves both as transportation and as schoolroom for the widely scattered school children.

of the first painters to gain distinction in Europe was James Wilson Morrice (1864–1924), whose work is represented in the Tate Gallery, London The first World War saw the birth of a genuine Canadian school of painting marked by fresh originality In Toronto, in 1920, was held the first exhibition of the Group of Seven These young painters were Lawren Harris, A Y Jackson Arthur Lismer J E H Macdonald, Frank Johnston, F Horsman Varley and Franklin Carmichael In the words of Arthur Lismer, the group attempts to portray not the photographic appearance of the Canadian scene, but its rhythm and grandeur They 'dispense with diverting detail in order to achieve broad design and mass effects A Montreal group, similar to the Seven in Toronto, has also gained wide recognition

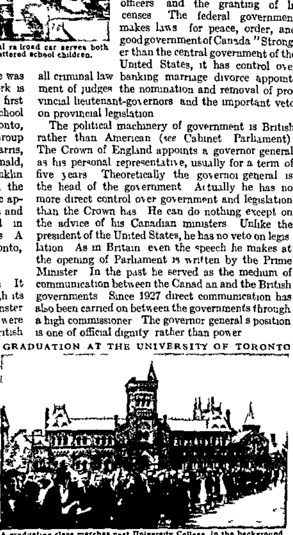
How Canada Is Governed

Canada is a completely self governing nation It conducts its domestic and foreign affairs through its own representatives By the Statute of Westminster (1931) all limitations on its lawmaking powers were removed Its constitution embodied in the British North America Act of 1867 formerly could be amended only by the British Parliament In 1949 the Canadian House of Commons voted to discontinue submitting constitutional amendments to the English Parliament The highest court of appeals remained the Privy Council in England until 1950 when the Supreme Court of Canada became the final tribunal Use of the word 'dominion was dropped in 1950 Upon becoming a nation in 1931 Canada elected to remain a member of the British Commonwealth under the sovereignty of the king who is king of Canada as well as of the United Kingdom

Like the United States Canada is a federal union, uniting ten provinces and two territories under a strong central government The constitution grants to the federal government all power not expressly given to the provinces The reverse is true in the United States whose constitution specifies the powers of the central government and grants all others to the states The provinces legislate on such matters as education, public works direct taxation to raise money for provincial purposes, borrowing money on the credit of the province guarantees of civil rights and property, administration of justice public institutions amendment of the provincial constitution except as regards the office of lieutenant governor appointment and payment of provincial officers and the granting of licenses The federal government makes laws for peace, order, and good government of Canada " Stronger than the central government of the United States, it has control over all criminal law banking marriage divorce appointment of judges the nomination and removal of provincial lieutenant-governors and the important veto on provincial legislation

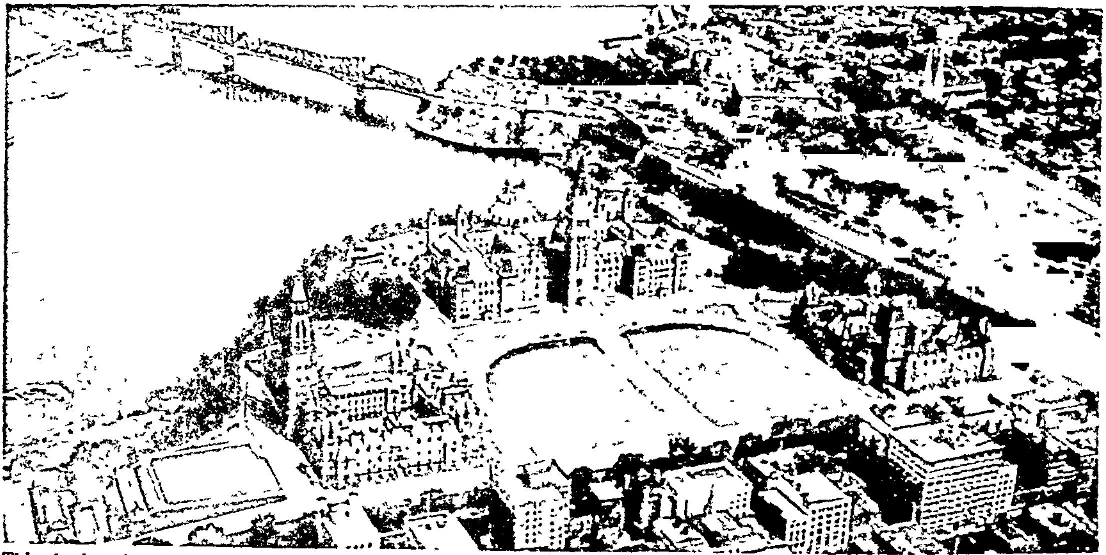
The political machinery of government is British rather than American (*see* Cabinet Parliament) The Crown of England appoints a governor general as his personal representative, usually for a term of five years Theoretically the governor general is the head of the government Actually he has no more direct control over government and legislation than the Crown has He can do nothing except on the advice of his Canadian ministers Unlike the president of the United States, he has no veto on legislation As in Britain even the speech he makes at the opening of Parliament is written by the Prime Minister In the past he served as the medium of communication between the Canadian and the British governments Since 1927 direct communication has also been carried on between the governments through a high commissioner The governor general s position is one of official dignity rather than power

GRADUATION AT THE UNIVERSITY OF TORONTO



A graduating class marches past University College in the background The University of Toronto founded in 1827 as King s College, has the largest enrollment in Canada

WHERE ALL CANADA IS GOVERNED



This air view shows the great quadrangle of government buildings in Ottawa, capital of the nation, where Canada's laws are made. On a bluff high above the Ottawa River rises the main Gothic Parliament Building, which houses the Senate Chamber, the House of Commons, and the Parliamentary Library. The Peace Tower, with its carillon of 53 bells, rises 291 feet above the Parliament Building. It is a memorial to the dead of World War I. On either side of the quadrangle are the East and West blocks housing other government offices. The long bridge in the background connects Ottawa with the city of Hull, Que.

The real head of the government is the prime minister, who is the leader of the majority party in the House of Commons. The governor-general invites him to choose a Cabinet, or ministry. He and his ministers must be members of Parliament. They remain in office only so long as they are supported by a majority in the House of Commons and must resign on a vote of want of confidence. If the Cabinet is forced to resign, the prime minister advises the governor-general to call upon the leader of the opposition party to form a new government.

Functions of the Cabinet

The Cabinet combines both legislative and executive duties. It introduces bills to the House, including the money bills. Without its support important bills on public matters stand little chance of passage. The Cabinet members head the various executive departments of the government, which correspond to those in the United States. The position of secretary of state is held by the minister for external affairs. Other ministries include finance, mines and resources, justice, public works, transport, pensions and national health, fisheries, agriculture, labor, trade and commerce, and postoffice. During World War II several defense ministries were created. There may also be ministers "without portfolio" (ministers without executive duties). The Canadian ministers are also members of the Queen's Privy Council for Canada, a purely honorary body. Legally, however, the Cabinet is a committee of this body, and all Cabinet ministers become privy councilors for life.

The Parliament is divided into two houses. The Senate consists of 102 members, appointed for life by the governor-general on the advice of the Privy Council. Legislation passed by the House of Commons can be voted down by the Senate, but this power is seldom used. Thus the Senate has little political influence, and its abolition has long been recommended.

The House of Commons is elected by the people for the duration of Parliament, which may not be longer than five years. As in the United States it is a representative body. Representation is proportionate to the population of each province. The present House has 262 members, but the next Parliament will have 265 seats as provided by the British North America Act of 1952.

The provincial governments are headed by a lieutenant-governor, who is appointed by the governor-general. He acts only on the advice of his provincial Cabinet, headed by a prime minister. The minister is responsible to the legislature. All legislatures are unicameral, except that of Quebec, which has two houses—a Legislative Assembly elected by the people, and a Legislative Council of 24 members appointed by the lieutenant-governor for life. Any British subject 21 years of age or over may vote if he has been a Canadian resident for one year.

The Canadian Court System

There are three federal courts. The Supreme Court consists of a chief justice and eight puisne, or associate, judges. It has appellate jurisdiction in both civil and criminal cases. The Exchequer Court has jurisdiction over all claims affecting the interests of the Crown and those concerning copyrights, trademarks, and patents. The Admiralty Court is a division of the Exchequer Court. It handles cases relating to shipping, navigation, trade, and commerce. Each province has a supreme court. Judges are appointed for life by the governor-general on the advice of the federal Cabinet.

REFERENCE-OUTLINE FOR STUDY OF CANADA

I Location and size C-65 chart U 246 location in world map W 204 in North America map N 250 political divisions map C-68-9 air distances polar projection map A-531

- **A. The provinces** Alberta A 141-4 British Columbia B-312 17 Manitoba M 78-81 New Brunswick N 137 138b Newfoundland (with Labrador) N 139-40 L-76 Nova Scotia N-307 9 Ontario O-384-7 Prince Edward Island P-411 12 Quebec Q-4-8 Saskatchewan S-46-9
- **B The territories** Northwest Territories (provisional districts of Mackenzie Keewatin and Franklin) N 298 Yukon Territory Y-348

II Structure of the land C-67 75 N 247 maps C-67 86 N 245

- **A Mountains and plateaus** list C-65
  1. Appalachian system C-67 A 276 Notre *Dame Mountains Q-5 map C-73*
  2. Laurentian plateau or Canadian Shield L-137 N 265 picture C-70
  3. *Cordillera C- 6 B-313 Rockies R 173-6* pictures N 29 A 141 C- 0
- **B Interior plains or western prairies** C-75-6
- **C Rivers and lakes** C 77 *list C-65 map U 256-7*
  1. Great Lakes G 178-85
  2. Rivers Columbia C-415a Mackenzie M 15 picture C- 6 Peace P 102-3 Red R-88 St Lawrence S-19 21 Yukon Y-348 picture N 255
- **D Coastline and islands** C-75 C-117 N 139-40 *P-411* V-437
- **E Land changes in past ages** N 264 5 Ice Age I-4-7 G 184 G-54 Niagara Falls N 230

III Climate C-77 8 N 248 253 P 103 affects plants and animals map N 258 summer and winter winds maps N 248 rainfall maps N 246 R 71

- **A Eastern oceanic** N-30 8 N 139 *P-411*
- **B Eastern** Q-6 L-76 O-384 Great Lakes G 180
- **C Prairie** M 79 S-47 A 142
- **D Pacific coast and mountain** B-313 14
- **E Arctic regions** A-3?7 8 Y 348

IV Plants and animals C-78 N 258-63 color pictures N 259 62 Arctic A-328 color pictures A-329 (caribou C-122 reindeer R-97)

V Where and how the people live C-65 8 83 map N 245 immigration and emigration C-67 83 citizenship C-83 holidays and games F-56 L-82-4

- **A Atlantic region** *Newfoundland and Labrador* N 139 140 L- 6 Maritime Provinces C-83 (New Brunswick N 138a Nova Scotia N-308 picture C-70 Prince Edward Island P-412)
- **B St Lawrence Valley and Ontario Peninsula** *C-75* S-20 *pictures* C-89 91 Quebec French *C-83 Q-4 M-381 Q-9-10 pictures* C-83 Q-6
- **C Prairie Provinces** M 78 79 S-47 *A 143*
- **D Rocky Mountains and Pacific coast** B-313-14
- **E Indians and Eskimos** I 112 E-393-7 C-83

VI Resources and industries list C-65 products maps N 256 257 occupations pictograph C-66

- **A Forests and forest products** *C-78 87 L-340,* N 263 map N 246 picture N 244
  1. Eastern N 138a N 140 L-76 N-308 O-386 Q 7 pictures *C-88 N 138*
  2. Western A 143 B-314 M 79 S-47
- **B Agriculture** C-84-6 N 255 products map N 257 cultivated land map A 71 irrigation I 253 wheat W 115-18 picture C-70
  1. Maritime Provinces and Newfoundland N 138a N 307 P-411 N 140 picture C-85
  2. Quebec and Ontario Q-6-7 O-384 pictures Q-4 C-64 0 O-384 5 maple products M-83
  3. Prairie Provinces Manitoba M 78-9 Saskatchewan S-46-7 Alberta A 142 143 P 103
  4. British Columbia B-315 V-437
- **C Fisheries** C-86-7 F 115-17 L-287
  1. North Atlantic New Brunswick N 138a Newfoundland and Labrador N 139-40 L-76 Nova Scotia N-308 C 118 picture C 0 Prince Edward Island P-412 Quebec Q
  2. Inland waters Great Lakes G 184 Hudson Bay H-437 Manitoba M 9 *picture* M-80 Saskatchewan S-48 Alberta A 143
  3. Pacific British Columbia B-314 picture C-87 *salmon S-28 seal* S-88
- **D Furs and fur trade** C-87 F-326 H-438 products map N 257 Alberta A 143 Manitoba M 9 *picture M-80 Nova Scotia N 308 Labrador* L- 6 Prince Edward Island P-411 Saskatchewan S-47-48
- **E Minerals and mining** C-87 8 L-137 A-326 N 254 list C-65 picture C-89 products map N 256 aluminum A 184 gold G 132 iron I 238 *248* petroleum *P 169* C-88 platinum *P-315* radium and uranium C-88 R-57 U-405 N 258
  1. Maritime Provinces and Newfoundland C- 5 N-308 N 138a C-118 N 140
  2. Quebec and Ontario Q 7 O-385-6 aluminum pictures Q 5 C-89 asbestos A-401 cobalt *C-372 emery E-339 nickel N 235 picture* N 234
  3. Western provinces M 79 S-48 A 142 B-314
  4. Yukon Territory and Northwest Territories Y-348 N 298
- **F Water power** C-77 W-69 O-385 O-428 Q 5-6 L- 6 P 103 Niagara Falls N 230 picture map N 231 Shipshaw Development C-77 Q-6
- **G Manufacturing** C-88-9 pictograph C-66 Alberta A 143 E-237 C-24 British Columbia B-315 V-437 V-468 Manitoba M 79 W 156 New Brunswick N 138a Newfoundland N 140 Nova Scotia N-308 H 249 Ontario O-384 5 H 253 K-47 L-307 O-428 T 154-5 W 156 S-51 pictures C-89 Prince Edward Island P-412 Quebec Q 7 8 M-381 Q 11 Saskatchewan S-48 R 96

VII Transportation and trade C-77 83-4 89 N 140 N-308 Q-7 O-385 M 79 80 Yukon Territory Y-348

- **A Principal seaports** Halifax H 248-9 picture N-309 Saint John S-18 picture N 138b Quebec Q-11 Montreal M-381 picture C-65 Vancouver V-437 picture B-316 Victoria V-468
- **B Rivers and lakes** C-77 *pictures C- 6 N 138a* Great Lakes G-178 maps G 181 183 picture O-385 St Lawrence S-19 map S-20 (St Lawrence Seaway Project S-20-1 R 157 C-103) Yukon Y-348 picture N 255

C. Canals C-77, C-109, S-19, map S-20: Rideau, picture O-428; Trent H-452; Sault Sainte Marie S-49-51; Welland Ship W-90, map N-231, picture C-76

D. Highways C-83-4: Alaska Highway C-84, R-158c, pictures C-64, 84; Pan American Highway project R-158f

E. Railroads C-83, 101, R-61, 62, 63, P-103: Toronto T-155; Windsor W-156, picture R-68; Winnipeg W-156; Regina R-96; Calgary C-24

F. Air transport C-76, 84, P-412, S-48, E-237, A-143: Gander Airport (Newfoundland) and Goose Bay Airport (Labrador) N-140, L-76; Arctic A-330

VIII. Communication: ocean cables C-5, 8, N-139, map C-5; telephones T-45; wireless C-118

IX. Principal cities, list C-65. For cities not listed below, see names in Fact-Index

A. Alberta, list A-141: Edmonton E-237, picture A-144; Calgary C-24

B. British Columbia, list B-312: Victoria V-468-9; Vancouver V-437, picture B-316

C. Manitoba M-79-80, list M-78: Winnipeg W-156, picture M-78; Churchill H-437

D. New Brunswick, list N-137: Saint John S-18

E. Newfoundland: St. John's (Fact-Index)

F. Nova Scotia N-307: Halifax H-248-9, picture N-309; Sydney C-118

G. Ontario O-385, list O-384: Toronto T-154-5, picture O-385; Hamilton H-253; Kingston K-47; London L-307; Ottawa O-428-9, picture C-92; Windsor W-156; Sault Sainte Marie S-51

H. Prince Edward Island P-412

I. Quebec, list Q-4: Quebec Q-9-11; Montreal M-380-1, picture C-65

J. Saskatchewan, list S-46: Regina R-96

K. Yukon Territory: White Horse, Dawson Y-348

X. Education and libraries C-90, L-199-203: Alberta A-143; British Columbia B-316, V-437, V-469; Manitoba M-80, W-156; New Brunswick N-138b; Newfoundland N-140; Nova Scotia N-308; Ontario O-386-7, K-47, L-307, T-155, pictures C-91, L-201; Prince Edward Island P-412; Quebec Q-8, M-381, Q-10-11; Saskatchewan S-48, R-96, picture L-202

XI. Art and science C-90-1, O-428, T-155, W-156

A. Literature C-105-7: Drummond D-156-7; Parker P-85-6. See also names of writers in Fact-Index

B. Scientific research C-90: Frederick Banting and Charles Best B-53; Arctic Institute A-330

XII. National government C-91-2: Parliament buildings, pictures C-92, O-428, L-202; administration of Yukon and Northwest Territories Y-348, N-298; Royal Canadian Mounted Police P-355b, pictures P-356, C-90; government libraries L-202

XIII. Provincial governments C-91: Alberta A-143, 144; British Columbia B-316; New Brunswick N-138b; Nova Scotia N-308; Ontario O-386, picture O-385; Prince Edward Island P-412; Quebec Q-8; Saskatchewan S-48, 49, picture R-96

XIV. Religion C-83: United Church of Canada C-304; dual education in Quebec Q-8

XV. National and provincial parks N-38f-39, A-141-2, W-156, C-117-18, O-386, Q-5, color pictures N-29, Map N-38f, pictures N-38f, A-141, C-117, N-307, A-6

XVI. History: see Reference-Outline for Canadian History

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The STIRRING STORY *of* CANADA'S PAST

At the mouth of the St. Lawrence, where gulf and river meet, explorers found an inviting entrance to the heart of a continent. This is the village of Percé at the tip of the Gaspé Peninsula. Beyond in the gulf rise Percé Rock and Bonaventure Island.

CANADIAN HISTORY. It is no accident that the story of the white man in North America begins in Canada. Nowhere does a coast open more inviting arms to the explorer. The broad Gulf of St. Lawrence, the St. Lawrence River, and the Great Lakes lead 2,400 miles into the heart of the continent.

Perhaps because of this very highway, Canada still *faces eastward across the sea to Europe*. It is the only country in the western hemisphere which has kept its political ties with the old world. Even more absorbing than the tale of early exploration is the story of a developing nation—the first to become an independent member of the British Commonwealth of Nations.

The Northmen Arrive

Nearly a thousand years ago a Norse seaman died far from home in the heart of a wild and unknown country. His comrades buried him, as was the custom, with his weapons—his iron sword, ax, and shield. Centuries passed by. In 1931 the rusted weapons were discovered at Beardmore, Ontario, near Lake Nipigon, north of Lake Superior. Scientists believe the relics to be Norse weapons of the period A.D. 900 to 1000. These are the earliest evidence of the white man in North America. The Beardmore Viking and his companions probably came from Norway to Iceland and Greenland, then through Hudson Strait into Hudson Bay, southward to James Bay, and overland on well marked Indian trails toward Lake Superior.

From the Norse tales of adventure, the sagas, we know that another Viking, Leif Ericson, visited the Atlantic coast of Canada about the year 1000 (*see* America). The Vinland which the sagas describe can not be located with certainty. Undoubtedly these daring sailors saw the rocky shores of Nova Scotia and the entrance to the Gulf of St. Lawrence.

Their journeys were long unknown to the rest of Europe. Although they continued to visit North America for 300 years, they made no permanent settlements. Meanwhile the great expanse that was to become Canada was left to a handful of Indians and Eskimos—probably never more than 200,000.

Among the leading tribes were the Iroquois, who lived on the shores of the lower Great Lakes, and the Hurons, on Lake Huron and Georgian Bay. Various Algonquian tribes occupied a broad belt from the Atlantic coast to the Rockies. Among these tribes were the Ojibwa or Chippewa of western Ontario and the Blackfoot of the Plains region. In the Mackenzie and Yukon river basins were the Athapascans. On the Pacific coast from Vancouver Island to Alaska lived the Haida, Tlingit, Tsimshian, and numerous other tribes. (*See also* Indians.)

Rediscovery and Exploration

In 1497 the continent of North America was rediscovered by John Cabot, an Italian merchant-sailor in the service of King Henry VII of England (*see* Cabot, John). Like Columbus a few years earlier, he was in search of a short route to Asia. After sighting Newfoundland, he sailed to Cape Breton Island. There he raised a huge cross and the English flag, thinking he had reached Cathay (China).

He was bitterly disappointed with these bleak coasts. Where were the cities with gold-encrusted towers and silver bells, the caravans bearing silks, spices, and jewels that Marco Polo told about? His son Sebastian commented without interest on the fact that the cod fish were so thick in the seas they could be scooped

up in baskets. Bears waded out from shore and caught them with their claws. The Cabots called the country Baccalaos, the Basque word for codfish.

To Catholic Europe, which ate a great deal of fish, this was an important discovery. Although Cabot's journey failed in its effort to reach Asia, it brought fishermen and fur traders to the new lands. And most important, it was the basis of England's claim to Canada almost 300 years later.

During the next 40 years it became clear that this was not Asia. Explorers then tried to find a northern passage to the "Western Sea" which we call the Pacific Ocean. Francis I, king of France and rival of the Spanish Charles V, was not to be outdone in the race for the rich trade of the East. Spain and Portugal had already agreed to divide the whole New World between them. Francis wrote a sarcastic letter to Charles asking for evidence that "our Father Adam" had made him and the King of Portugal "his universal heirs." In 1524 Francis sent out an expedition under the Florentine navigator, Giovanni Da Verrazano. Verrazano skirted the American coast from North Carolina to Newfoundland, and named the region around the Gulf of St. Lawrence "New France." France based its claim to North America on this journey. Ten years later Francis sent Jacques Cartier, a daring sea captain of St. Malo, to America to strengthen his claims and to seek a northwest passage to China (*see* Cartier, Jacques). Cartier was the first explorer to press beyond the coast line into the interior. On his second voyage, in 1535, he sailed up the St. Lawrence River as far as the Indian village of Hochelaga, the site of modern Montreal. There he climbed a steep hill which he named Mont Royal, the "royal mountain." From its summit the first white man to see this land gazed far over the beautiful countryside. Probably he too was bitterly disappointed to find only poor Indian villages where he sought splendid Oriental cities. He could not look ahead 400 years to see this same river teeming with the ships of two nations bearing rich cargoes of grain, oil, and lumber. He could not know that the forest-blanketed plateau to the north hid a priceless treasure of minerals, richer by far than the spices and jewels of the East.

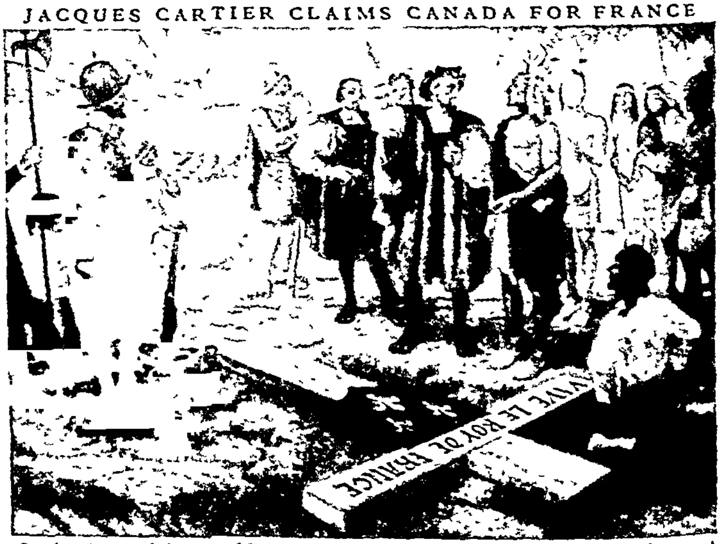
The Founding of New France

For the next 75 years France was too busy with civil wars to think of the wilderness across the sea. Then, with some peace and prosperity restored, Henry IV was able to give his attention to an enthusiastic young man named Samuel de Champlain (*see* Champlain, Samuel de). Just home from a voyage to Mexico, he was fired with the desire to create for France an empire as rich as Spain's. Furs were valued in Europe almost as highly as gold and silver. Champlain was convinced that before the fur trade could be built up, permanent settlements must first be established.

In 1605, with Sieur de Monts, he founded Port Royal (the present Annapolis Royal), on the Bay of Fundy, Nova Scotia. In 1608 he founded Quebec. New France at last was on a permanent basis. With the explorers and fur traders came missionaries to win the heathen Indians for the Catholic faith. The Recollet friars arrived in 1615, the first Jesuits in 1625. Madame de la Peltrie, founder of the Ursuline Convent in Quebec in 1639, and Marie de l'Incarnation, its first Mother Superior, were noble women whose self-sacrificing service to Indian and white alike helped to soften the violence of a frontier post. Montreal was founded in 1642 by the Society of Our Lady of Montreal as a mission. Sieur de Maisonneuve was its first governor, Mademoiselle Jeanne Mance the director of its hospital.

Farmers came, too, men content to cultivate the soil instead of growing rich in the fur trade. Louis Hébert, a Parisian druggist, who arrived in 1617, was the first of the *habitants*, as the French farmers are called who continue to be today such an important element in the population of Quebec.

JACQUES CARTIER CLAIMS CANADA FOR FRANCE



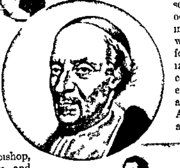
On the shores of the Gaspé Peninsula, in July 1534, Jacques Cartier erected a great wooden cross as a symbol of France's ownership of this land. Impressed by the ceremony, the Indians looked on.

Nothing but the determination of Champlain and the missionaries saved New France during the first half century of its existence. The home country gave it little support. Champlain had allied himself with the Hurons. Their enemies, the Iroquois, were determined to wipe out the French. They murdered the missionaries, raided the small, poorly defended settlements. In the winter of 1659-60 word came to the garrison at Montreal that several war parties were planning to close in on them. Instead of waiting for the attack, Adam Dollard des Ormeaux, the young officer in command at Montreal, went out to meet them. At

the foot of the Long Sault Rapids on the Ottawa River he and his heroic band were slaughtered But they had fought hard enough to discourage further attacks and so saved the colony

The colony at th s time was governed by the Company of New France organized by Cardinal Richelieu in 1627 This powerful group of 100 associates or partners not only enjoyed a perpetual monopoly of the fur trade, but actually owned the whole vast region of the St Law rence and Great Lakes Had it not been for Champlain and the missionaries misman agement would have destroyed the colony In 1663 King Louis XIV made the Company surrender its rights and New France became a royal colony

FOUNDERS OF NEW FRANCE



Three of the strong men of New France were Count Frontenac (top) governor for more than 20 years whose Indian wars broke the power of the Iroquois Bishop Laval (center) first rel gious leader and organizer of missions and hosp tals and Champlain (bottom) explorer and founder of the first permanent settlements

As in the home country, government was autocratic and feudal The governor appointed by the king was the civil and military ruler Another royal official the intendant directed justice and public fi nance The third important figure was the bishop, who ruled the religious life of the colony and supervised its education and the care of the poor New France was fortunate in having three strong men in these posts early in its history Frontenac who arrived in 1672 was a courageous and ef ficient governor (*see* Frontenac, Count Louis de) Jean Baptiste Talon first intendant built up the population of the country by encouraging imm gration and granting bounties to large families He strengthened outlying mil tary posts fostered domestic industries and attempted to make the colony self-sustaining The place of the Roman Catholic Church in the lives of modern French Canadians is due very largely to the work of the first bishop Francois Xavier de Laval Montmorency

Under the feudal system of France the land was owned in huge grants by the seigneurs or lords The *habitant* was a dependent of the seign eur He paid him fixed sums of money for the privilege of cultivating and living on the land and performed certain services Actually the farmer was almost completely free and his obl gations to the seigneur were slight The system was retained long after New France became a British colony, although it was abolished in the home coun try by the French Revolution

The great names that march across the pages of Canadian history dur ng this period are many and their story is told elsewhere in these books Jean Nicolet Radisson and Grose lliers Marquette Joliet and La Salle were among the traders and miss onaries whose deeds are equally important in the history of the United States

English Rivalry in Canada

The English meanwhile were pressing their own interests in North Amer ca Martin Frobisher John Davis and William Baffin were seeking the North west Passage through the polar seas about the same time that Champla n was discover ng the Great Lakes (*see* Polar Exploration) Henry Hudson in 1610 sailed across the bay that bears h s name (*see* Hudson Henry) Nor were the French to be permitted a mo nopoly of the rich fur trade The early history of northwestern Canada is the history of The Governor and Company of Adventurers of England trading into Hudson s Bay The r charter issued by Charles II of England in 1670 gave them sole trading rights in all un occupied lands which drain into Hudson Bay The area was named Rupert s Land for Prince Rupert the organ izer of the Company and a cous n of the King It cov ered all of present Manitoba and Saskatchewan most of Alberta northern Quebec and the Northwest Territor ies Just 200 years later the Company transferred its lands to the newly created Dominion of Canada but kept its fur monopoly (For the story of this great Company *see* Furs and Fur Trade Hudson s Bay Company)

To the south the Atlantic seaboard was filling up and the Engl sh were push ng westward Virgin a alone had many more people than all New France whose pop ulation in 1673 was only 7,000 Conflict between the French and English could hardly be avoided It came violently

In 1689 the first of a series of four intercolonial wars broke out (*see* French and Indian War). The second, Queen Anne's War, ended with the Treaty of Utrecht (1713), by which France suffered serious territorial losses. It was forced to surrender to England all claims to Acadia (Nova Scotia), Rupert's Land, and Newfoundland. Driven from Acadia, the French built powerful Fort Louisbourg on Cape Breton Island to protect the entrance to the St. Lawrence River. The English founded Halifax to offset the menace of this "pistol held at England's head."

The last of the intercolonial wars opened in 1754. One tragic episode was the exile of the Acadians from Nova Scotia, made famous by Longfellow's poem 'Evangeline' (*see* Acadia). With the 12-weeks' siege of Quebec (1759), French rule in North America ended. This is considered one of the decisive battles which changed the course of world history. The ancient city under the command of the Marquis de Montcalm fell before the attack of the English general, James Wolfe. Both commanders died on the field of battle. (*See* Montcalm; Wolfe). By the Treaty of Paris (1763) Canada was ceded to Great Britain. All that now remains of the French possessions in North America is two small fishing islands, St. Pierre and Miquelon, which lie near Newfoundland off the Gulf of St. Lawrence.

GRANTING THE HUDSON'S BAY CHARTER

King Charles II of England (right) signs the charter giving a fur-trading monopoly to the Hudson's Bay Company, May 2, 1670. His cousin, Prince Rupert (left), was the first governor. The land included all northern Canada from Labrador to the Rockies.

The Canadians Under British Rule

The new British regime was friendly and tolerant. General James Murray, the first military governor, insisted that the French be given freedom of worship and civil rights under the French civil law—rights later guaranteed by the Quebec Act of 1774. They were subject, however, to English criminal law. Murray was succeeded in 1766 by Guy Carleton. For the next 30 years Carleton guided the destiny of Canada. He has been called the "Father of British Canada" as Champlain is called the "Father of French Canada." During the long struggle of the American Revolution it was this firm-handed, despotic governor who kept Canada loyal to Great Britain. He disastrously defeated Benedict Arnold in the siege of Quebec, and the Americans made no further attempt to invade Canadian territory.

An important aftermath of the American Revolution was the influx of some 40,000 United Empire Loyalists—citizens of the American colonies who had remained loyal to King George. They settled in southern Ontario and in the Maritime Provinces, becoming the founders of English-speaking Canada.

With them they brought the tradition of representative government. Government in New France had been despotic. Under the Quebec Act there had been a Council appointed by the Crown, and an autocratic governor who could and often did ignore the advice of the Council. At the insistence of the Loyalists, the Canada Act of 1791 separated Lower and Upper Canada. Lower Canada was French: Upper Canada, west of the Ottawa River, was British. They correspond to the present Quebec and Ontario. The Act also created four colonies in the maritime region—Nova Scotia, New Brunswick, Prince Edward Island, and Cape Breton Island. No government was set up for the West. Each colony had its own lieutenant-governor under a common governor-general, and a legislature of two chambers. The lower house was elective. The rights of the Roman Catholics were again guaranteed, and provision was made for the support of a Protestant clergy. Guy Carleton remained as governor of Lower Canada. John Graves Simcoe was the first governor of Upper Canada. In this enormous wilderness populated by a handful of pioneer farmers, Simcoe had to build an empire. He created counties for the election of representatives to the assembly. He established a system of courts. He planned new settlements, constructed military roads and bridges, founded the capital city of York, now known as Toronto. He even encouraged the migration of new settlers from the United States.

Exploration of the West

While these historic events were taking place in eastern Canada, the West was slowly being opened to settlement. In 1731 a French Canadian and his three sons had hunted for a short route to the Western Sea. Pierre de la Vérendrye explored the country around Lake of the Woods and Lake Winnipeg, and discovered the Saskatchewan River. He and his sons established a chain of trading posts in this region.

Samuel Hearne, a trader in the employ of the Hudson's Bay Company, in 1771 followed the Coppermine River to the Arctic Ocean and discovered Great Slave Lake. He was thus the first white man to reach the Arctic by an overland route. A few years later, in 1778, Captain James Cook explored the west coast of Canada from Vancouver Island to Bering Strait. He sailed through the Strait into the Arctic in search of the passage between the Pacific and Atlantic oceans, but was stopped by ice. George Vancouver charted the coast in 1792-93. Vancouver Island, Puget Sound, and other places were named by him.

DEATH OF BROCK AT THE BATTLE OF QUEENSTON HEIGHTS

Urging his men to push on General Isaac Brock lies dying on the batt efield H s brilliant leadership at Queenston Heights October 1812 repelled an invasion by American forces twice as large as his own

One of the greatest explorers of the Canadian West was Alexander Mackenzie a partner with the North West Company In 1789 he followed the Mackenzie River, which bears his name from its source to the Arctic Ocean In 1793 he reached the Pacific Ocean by way of the Peace River—the first European to cross the continent After Mackenzie came David Thompson one of the greatest of all geographers He surveyed the Columbia River and explored and mapped the prairies and mountains

By 1811, when Thompson s work was completed, much of western and northern Canada had been explored The only settlements however were the fortified posts of the fur traders In 1811 Thomas Douglas, Lord Selkirk bought 100 000 acres of land in the Red River and Assiniboine valleys from the Hudson s Bay Company as a refuge for Scotch Highlanders In spite of the hostility of the traders these farmers succeeded in establishing the first permanent settlements on the prairies which were destined to become one of the world s greatest granaries

The War of 1812

Canada and the United States were bad neighbors for many years after the close of the American Revolution On the frontier there was constant friction Pioneers were pushing into new land But the Indians were blocking the way westward with desperate determination to save their hunting grounds The peaceful country of the north looked more and more desirable to the land hungry Americans Moreover, they believed that Canada was arming the Indians In Congress a group called the War Hawks' was clamoring for annexation of Canada

The immediate excuse for the war was the seizure of American seamen by British warships, and other violations of America s neutral rights during the Napoleonic wars (*see* War of 1812) The first American objective of the war was to seize Canada This seemed easy Its population scattered over a great area was half a million Upper Canada which the Americans most desired, had only 90 000 people, the United States had more than seven million

Instead of weakly surrendering however, the Canadians with the aid of British army and navy regulars, gave the United States a shock early in the war by capturing Detroit under the able leadership of Sir Isaac Brock and his Indian ally, Chief Tecumseh Most of the fighting on the border occurred in the Niagara peninsula and most of it was indecisive Canada succeeded in clearing the enemy from its side of the Niagara River and at the end of the war it held Fort Niagara on the American side and Fort Michilimackinac at the entrance to Lake Michigan

In the defense of their country against an enemy of vastly superior resources, the Canadians showed great courage and ability The struggle united the British and French and gave the people a new self-confidence

Struggle for Self Government

After the War of 1812 Canada was able to give more thought to its government The Act of 1791 which created Upper and Lower Canada provided for *representative* but not for *responsible* government The lower house of the legislature in each province was elected by the people, but it had practically no power All bills had to pass the upper house and the governor-general and might then be rejected by the home government

The governor-general was appointed by the British Crown He was advised by an Executive Council which he himself chose from the upper house of the legislature The members of this Upper House had been appointed by the governor general or his predecessors The Legislative-Executive Council was there-

fore responsible to the governor-general and he to the home authorities, but no one was responsible to the people. As the governor-general was a stranger to the country, and served only for a few years, the ruling power actually fell into the hands of the few men in the Legislative-Executive Council, who held office for life. They and their friends and relatives held all the important official positions. Moreover there was no system of municipal government and so even local matters were decided by this small central body. In Upper Canada the autocratic government was ridiculed as a "Family Compact." In Lower Canada the discontent with the "Chateau Clique" was made more bitter by racial differences. The French Catholics resented being governed by a small minority of British Protestants.

Two ardent leaders of the reform movement appeared simultaneously in the two provinces—William Lyon Mackenzie in Upper Canada, and Louis Joseph Papineau in Lower Canada. Both men inflamed their followers into armed rebellion in 1837 (*see* Mackenzie, William Lyon; Papineau, Louis Joseph).

The uprisings were failures. The poorly organized bands of rebels were easily subdued by government troops, and the two leaders fled to the United States. The revolt did, however, direct the attention of Great Britain to the issues at stake, and hastened their reform by many years. In the meantime the Maritime Provinces were more peaceably agitating for similar reforms under the leadership of Joseph Howe in Nova Scotia, and Lemuel Allan Wilmot in New Brunswick (*see* New Brunswick; Nova Scotia).

In 1838 the Earl of Durham was sent to Canada to investigate the grievances of these troublesome colonies and to establish order. His "Report on the Affairs of British North America" is considered one of the greatest state papers in the English language. It outlined the plan which later resulted in the present government of Canada and laid down the principles of British colonial policy which have since prevailed.

Lord Durham recommended that responsible government be obtained by means of a cabinet which should have the support of the majority of the elective Lower House. The appointive Upper House he wished to retain as a check on the assembly. The colonial governor should act in harmony with the strongest party in the legislature, and should select his advisers from that party.

His second important recommendation was the union of Upper and Lower Canada under one government. The Act of Union was passed in 1840, becoming effective the following year and the two provinces were subsequently known as Canada West and Canada East. The Maritime Provinces remained separate. The purpose of the Union was largely to eliminate racial controversies by absorbing the French people into the English population. Durham did not understand the tremendous vitality of the French, and their determination to cling to their own ways of life. United Canada, therefore, still had many political problems to solve.

The first and most important recommendation dealing with responsible government was not put into effect until 1848. Lord Elgin, then governor-general, was a son-in-law of Lord Durham. He shared the older man's vision of Canada's destiny, but realized, as Durham did not, that the French must be given a voice in their own government. He asked Robert Baldwin and Louis Hippolyte LaFontaine jointly to form a new ministry. These were the leaders respectively of the English-speaking and the French-speaking members of Parliament (*see* Baldwin, Robert). The 1849 session of Parliament under their guidance was one of the greatest in the country's history. Nearly 200 bills became law. A Municipal Corporations Act gave self-government to counties, villages, and townships. The judicial system was revised. The University of Toronto was refounded as a non-sectarian school. Railroad building was promoted.

Enraged at the new liberalism, the extreme Tories rioted in Montreal in 1849 and burned the Parliament buildings. They even declared for annexation to the United States. Their violence ruined the Tory party and the new Conservative party which took its place has continued to the present day.

Beginnings of Confederation

The next decade saw rapid changes, a broadening outlook, and new responsibilities for the weak and divided colonies. Steamships were bringing in immigrants. Telegraphy and the cable were coming into common use. Everywhere people were on the move, exchanging ideas. Yet commercial intercourse was hindered by tariff barriers between the colonies, and different standards of currency, banking, weights and measures. The geographical barriers between them were becoming increasingly serious (*see* Canada). Each area had closer associations with the United States to the south than with the rest of Canada across thousands of miles of wilderness to the east and west. There were no intercolonial railroads to link the diverse elements. On the other hand the expanding American railways were drawing the trade of the Maritimes to Maine and New York, the commerce of the Red River region to Minnesota and the Middle West. Forty-niners, pushing northward after the California gold rush, discovered gold on the Fraser River in 1856, on Cariboo Lake in 1860, and began settlement of British Columbia. The threat of being absorbed piecemeal by the United States was very real.

The American Civil War (1861-64) underlined Canada's need of unity. Slavery, prohibited in Upper Canada after 1793, was abolished throughout the British Empire in 1833. For years Canada had been the destination of the "underground railway," and Canadian sympathies were with the North. But the North's blockade of Southern shipping, depriving English mill owners of cheap cotton, caused blockade-running that almost embroiled Britain and the North in war. Northern extremists revived the old cry of "manifest destiny" (that all of North America should become a part of the United States); irresponsible raids across the border, and the Maritime Provinces' open-

ness to blockade and invasion by sea, emphasized the necessity of defense (*see* Civil War American) Yet because of the lack of railroads British troops had to be transported from New Brunswick to Quebec across United States territory in Maine

Like railways and defense, trade depended upon uniting the provinces The 10-year reciprocity treaty which Lord Elgin had negotiated was due to lapse in 1864 Since the United States appeared unlikely to renew it, the provinces must foster trade among themselves

At the same time that these problems were becoming critical, a deadlock was developing in the Canadian legislature The new Conservative Party, created after the ruin of the Tories was led by John A Macdonald of Canada West (*see* Macdonald Sir John Alexander), and George Étienne Cartier of Canada East Opposing them was George Brown, founder of the Toronto *Globe* and leader of the Liberals (called 'Clear Grits," from their slogan 'Clear grit all the way through) From 1850 to 1864 party forces in Parliament were so evenly divided that no ministry could remain long in power In 1864, after two elections and three changes of Cabinet within three years, political progress became impossible Despite his dislike of Macdonald George Brown met him in friendly discussion on the floor of the House and announced his decision to overlook party differences and to cooperate with him and with Cartier In thus taking second place to Macdonald, Brown made possible the Coalition of 1864 This was the first step toward Confederation, for the Coalition was formed with the understanding that East and West Canada were to become a federal union, with a central government for common interests like defense, and provincial authority over local matters The Maritime Provinces were to be invited to join

To a Maritime Union conference at Charlottetown, P E I, in September 1864, the Coalition sent Macdonald, Cartier, Brown, Alexander Galt, and Thomas D'Arcy McGee a former Irish nationalist who was later killed by a Fenian in Ottawa They argued so persuasively for union of all British North America that the conference moved to Halifax and Saint John, where the plans were explained to the people

At another conference, at Quebec, in October, delegates representing every province signed the 72 Quebec Resolutions, the plan of union underlying Canada's Constitution Assuring each province control over local affairs, these resolutions demanded a strong national government to control defense, trade, tariffs and criminal laws, and to appoint judges and provincial lieutenant-governors A railway was to be built between the Maritime Provinces and Canada, and another to open Red River and the Northwest to settlement and bring British Columbia into the union

Objections from French-speaking Canada East, jealous of its independence, were overcome but Confederation was defeated in the Maritime Provinces Depending on import duties to finance their governments, they feared national control of tariffs Agreements that each province should receive annually from the national government 80 cents for every person in its population led to the cry that the people had been 'sold for the price of a sheepskin" Although the British government favored Confederation, the cause seemed lost at home

Dominion and Expansion

Confederation was saved by a fanatic anti-British pro-Irish group the Fenians, operating from the United States whose intention was to invade Canada and use it as a base for conquering England In 1866 border raids from Detroit to New Brunswick and renewed demands by American newspapers for annexation showed Canadians the dangers of disunity In December Macdonald and other delegates from Canada, New Brunswick, and Nova Scotia attended the third of a series of Confederation conferences in London In March 1867 Britain's Parliament passed the British North America Act based on the Quebec Resolutions and on July 1, 1867—since celebrated as Dominion Day—the Dominion of Canada was created

Canada s peaceful change from colony to Dominion laid the groundwork for that remarkable association of dominions and homeland bound only by their common allegiance to the Crown known today as the British Commonwealth of Nations Canada West and Canada East, renamed Ontario and Quebec, were given separate provincial governments New Brunswick and Nova Scotia retained theirs Ottawa became the capital of the Dominion government (For an account of the form of government *see* Canada)

Macdonald was chosen first Prime Minister and for the next quarter century, except for the years 1873-78, he guided the policies of the expanding nation The first new territory to be acquired was Rupert s Land The Hudson's Bay Company had discouraged settlement, to keep its lands for trappers and fur animals But defending such immense territories proved too difficult, and the advancing United States threatened to annex the Canadian West The Dominion paid the Company £300 000 (about $1 500, 000), and allowed it to keep its trading privileges and an amount of land equal to one-twentieth of the prairie lands west of Lake Winnipeg (For present holdings and trade, *see* Hudson's Bay Company)

In 1869 the only important colony between Ontario and British Columbia, established in the Red River Valley in 1811 by Lord Selkirk as a refuge for impoverished Scotch Highlanders had a population of 12 000 Most numerous were the *métis* descendants of French Canadian trappers who had married Indian women When William McDougall arrived as governor to take over the territory from the Hudson s Bay Company, he was met by armed *métis* led by Louis Riel, an educated but unstable half breed who opposed Dominion rule McDougall retired across the border while Riel organized a provisional government and demanded civil and land rights which Ottawa had neglected Opposed by settlers from Ontario Riel hastily had one of them, Thomas Scott, executed thus causing bitter racial feeling throughout the Dominion

Two men who understood the métis went to Ottawa to attempt a settlement of their grievances. These were Donald Smith (later Lord Strathcona), a Hudson's Bay Company factor, and Bishop Taché, the settlers' religious leader. As a result of their discussions the Manitoba Act of 1870 created the province of Manitoba, with a provincial government at Fort Garry (later Winnipeg). The French settlers' right to their religion and schools was recognized, but the Dominion retained control of land and natural resources. The government's determination to uphold its laws was made clear by dispatch of Canadian and British troops under Colonel (later Sir) Garnet Wolseley across 500 miles of trackless territory from Toronto to Fort Garry. Riel's forces were defeated and he went into temporary exile beyond the border.

Canada Reaches the Pacific

Relations between Canada and the United States were improving. British, Canadian, and American delegates met at Washington in 1871 to settle differences that had repeatedly threatened to plunge their countries into war. Macdonald, heading the Canadian delegation, withdrew Canada's claims for compensation from the United States for the Fenian raids, in the face of American claims against Britain for having built the *Alabama* and other Civil War blockade runners. (*See* 'Alabama' Claims.) This conference produced, in the Treaty of Washington, agreements on joint Canadian and United States use of the Great Lakes-St. Lawrence waterway and the Yukon River in Alaska, the Oregon boundary settlement, and reopening of Atlantic fisheries to the United States. Canada's reciprocal trade agreement was not renewed, but a commission fixed $5,500,000 as the United States payment for fishing rights.

Although Britain promised loans for Canadian railways in return for Dominion concessions, Macdonald was bitterly disappointed at Canada's few benefits from the conference, and his sacrifice of Canadian interests made him unpopular. In Confederation he had achieved one of his two major goals. Moving toward the second—expansion of the Dominion from sea to sea—he became more unpopular. British Columbia joined the Dominion in 1871 on condition that the Pacific railway be built within 10 years. Completion of an Intercolonial Railway from Halifax, N.S., to the St. Lawrence had been an important condition of Confederation. The British Government guaranteed a loan of £3,000,000, and in 1873 the joining of existing railways in the Maritime Provinces and Quebec had so increased prosperity that Prince Edward Island entered the Confederation. Newfoundland, with its dependency, Labrador, did not become a province until 1949. (*See* Newfoundland; Labrador.)

Struggles to Build a Railway

But building a railway across the rock and forests of the Canadian interior from Ottawa to Winnipeg, and thence across the prairies and the Canadian Rockies, was an undertaking which many believed would never pay for itself. It took all Macdonald's skill to obtain from Parliament financial backing and huge land grants for the railway builders. After the elections of 1872, contracts were awarded to Hugh Allan, of Montreal, and American financiers. It was discovered that these men had contributed heavily to the Conservative party's campaign funds. The "Pacific Scandal" rocked the Dominion and Macdonald's government fell. In 1873 the Liberals came into power with Alexander Mackenzie as prime minister.

Mackenzie, although industrious and persevering, lacked Macdonald's shrewdness. Concerned chiefly with administration, he lost touch with his party and the people. Yet from 1873 to 1878 he and his minister of justice, Edward Blake, accomplished much. Their General Election Law abolished property tests for membership in the House and introduced voting by ballot, a reform George Brown had demanded. Blake brought about establishment of the Canadian Supreme Court and the Court of the Exchequer.

The government, changing Macdonald's plans, began itself to build the Pacific railway section by section to Winnipeg. Progress being slow, a telegraph line and a wagon road were built to offset criticism from British Columbia. The West, troubled by lawlessness, was insecure. The government organized the North West (now called Royal Canadian) Mounted Police in 1873; and the following summer 300 "Mounties" rode westward, drove border whiskey-runners from the plains, and began the reign of law in the Northwest. White men had destroyed the buffalo herds on the great plains, and the Indians, depending on buffalo meat for food, faced starvation. The Mounted Police helped to establish the tribes on reservations where, under a Department of Indian Affairs, they were taught to support themselves by agriculture. Even the warlike Sioux became peaceful farmers.

Macdonald's National Policy

A serious depression handicapped the Liberal régime, and construction of the Pacific railway lagged. The Conservatives returned to power in 1878 with Macdonald's National Policy—enactment of high tariffs to protect Canadian manufacturers, rapid completion of the Pacific railway, opening of the lands west of Manitoba to settlement. These policies, aided by good harvests and a revival of the lumber trade with Great Britain and the United States, made the following years prosperous for Canada. The Dominion's territorial expansion was completed when, in 1880, Britain transferred to Canada the Arctic areas beyond the Northwest Territories. But the crowning achievement of Macdonald's second administration was the completion of the railway to British Columbia. The Canadian Pacific Railway Company was awarded a contract, including 25,000,000 acres of land; and Donald Smith (Lord Strathcona) drove the last spike in November 1885 at Craigellachie, in the Rockies.

The railway crossed the prairies none too soon. In 1870 Macdonald had neglected the métis' demands for civil and land rights at Red River. He now repeated this mistake with métis who, settling in the Saskatchewan Valley, feared loss of their lands as newcomers came westward. Louis Riel returned in 1884; and in

March 1885 the métis again rebelled aided by 20 000 dissatisfied Indians Troops hurried west by rail captured Riel s headquarters at Batoche Riel surrendered and was tried and hanged But French Catholic agitation after his execution turned Quebec against the Conservatives Macdonald s health broke and in 1891 he died

The Conservative majority in Parliament then chose four prime ministers within five years The ablest was Sir John Thompson during whose term the Bering Sea controversy with the United States was settled by arbitration in 1892 Against American claims the Bering Sea was declared open ocean and Canada was awarded $425 000 compensation for seized vessels The United States was upheld when open-sea hunting of fur seals with explosives or within 60 miles of the Pribiloff Islands was forbidden

From 1891 to 1896 was a stormy period The farmers suffered from depression for tariff protection had raised the prices of manufactured goods Immigrants came in slowly and the West remained undeveloped Thousands of young men drawn to the prairies by the building of the railroad became discouraged and emigrated to the United States. The Conservative government was finally defeated on religious issues stirred up by Manitoba That province in 1890 had established a system of non sectarian schools and abolished the privileges guaranteed the French Ottawa ordered Manitoba to restore the privileges Manitoba argued that the Dominion constitution gave it control over education and refused Feeling ran high and in 1896 the Liberals returned to power with a large majority

Laurier and Liberalism

Wilfrid (later Sir Wilfrid) Laurier a member of Mackenzie s 1878 Cabinet became prime minister (*see* Laurier Sir Wilfrid) the first French Canadian to lead his country in this office His 15 years as premier were years of growth and prosperity He compromised the Manitoba quarrel by restoring religious instruction in the public schools and teaching by the bilingual system for ten or more children whose native tongue was French He strengthened Dominion trade with Britain by lowering some tariffs and removing duties on goods needed by farmers Canada shared increasing world prosperity Sir Clifford Sifton minister of the interior advertised the Dominion s advantages to farmers and from 1896 to 1914 3 million immigrants came from Great Britain the United States and Europe Saskatchewan and Alberta were admitted to the Dominion in 1905 and with Manitoba these prairie provinces became the world s greatest wheat-growing region The East found new markets for its products in the West and manufacturing grew rapidly Laurier s government granted cash and land for construction of the Canadian Northern and Grand Trunk Pacific railways By 1916 only the United States Germany and Russia had more than Canada s 40 000 miles of railways The scattered population could not support such mileage During the first World War all save the Canadian Pacific were nationalized in the Canadian National Railways

DRIVING THE LAST SPIKE IN THE CANADIAN PACIFIC

In the old photograph above Donald Smith (who became Lord Strathcona) is shown driving the last spike in the Canadian Pacific Railway at Craigellachie in the Rockies Nov 7 1885 After years of disheartening difficulties Canada was at last united by a transcontinental railroad.

Relations with the United States

Discovery of gold in the Klondike and the Yukon in the 1890 s caused disagreement with the United States over Alaska s boundary Arbitration in 1903 gave the United States coastal territory along British Columbia shutting Canada from the seaports north of the Dixon Entrance This was the last serious disagreement between the two countries An International Joint Commission established in 1909 settling controversies over the use or diversion of waters crossing the international boundary or flowing from boundary waters has pointed one way toward world co-operation Controversy over fishing rights was ended in 1910 and a new agreement on fur sealing reached in 1911 The United States in 1911 sought a reciprocal trade agreement with Canada but when Laurier presented the plan to Parliament also asking for naval vessels as a defense against the growing might of Germany his government fell

Dominating the Dominion's first 44 years, Macdonald and Laurier had made it a strong federal union, extending, as the motto carved in a stone of the Parliament Building at Ottawa announced, *A Mare usque ad Mare*—"From the sea even unto the sea."

Canada in the First World War

Robert Laird Borden was Conservative prime minister from 1911 to 1919 (*see* Borden, Robert Laird). In 1914, the first World War involved Canada with the Empire against the German-Austrian alliance. Henri Bourassa, Quebec Nationalist leader, pledged French Canadian support. The Dominion played a brilliant part in the war. Canadian Expeditionary Forces numbered more than 400,000 men overseas: Canada sent the Allies wheat, lumber, and vast amounts of munitions. Canadian troops in 1917 took strategic Vimy Ridge, and in one of the war's bloodiest battles, Oct. 9, 1918, captured Cambrai and helped win the war, in which 62,817 Canadians were killed and 127,000 wounded. One of the war's greatest disasters occurred at Halifax, when a French ship carrying nitroglycerine and gasoline collided with a Norwegian vessel. The explosion killed or injured 5,800 persons and destroyed two square miles of the port.

Early in the war Canada's military forces were recruited from volunteers. By 1917 it became necessary to adopt conscription. Violent opposition came from Quebec under the leadership of Bourassa. Laurier believed that Parliament should not adopt conscription without holding a referendum on the question. His position split the Liberal party, but events proved him to be right. The Military Service Act resulted in division and misunderstanding between the English and French which was to break out anew in the second World War 25 years later. There were serious draft riots, and in other parts of the Dominion conscription also fell short of success.

A short but severe depression caused political unrest before postwar industries revived. Laurier died in 1919, and Borden presently retired.

Progress Toward Self-Government

After a brief administration by Arthur Meighen, Conservative leader, William Lyon Mackenzie King, grandson of the leader of the 1837 rebellion, became the Liberals' prime minister in 1921. Automobiles, radio, and airplanes brought the provinces closer together, busses and trucks operated over extensive surfaced roads, and canal and railroad transportation increased. Combines, harvesting wheat on a large scale, lightened farm drudgery and speeded the organization of cooperative wheat-marketing pools. The Welland Ship Canal, taking lake ships past Niagara Falls, helped Canada ship its wheat, lumber, and paper to Europe. Nickel and radium mining brought new settlements in the vast interior. Peace River and northern Quebec's frontiers were opened to homesteading war veterans. Meighen was Prime Minister for another short period before the elections of 1926 returned Mackenzie King to office.

Canada had made notable progress toward self-government as a result of the events of the first World War. Her prime minister had been a member of the Imperial War Cabinet which directed the war policy of the Empire. At an Imperial Conference, held in 1917, Borden had obtained the passage of a resolution that the Dominions "should be recognized as autonomous nations of an imperial commonwealth." At the Peace Conference of 1919, and in the League of Nations, Canada had been represented by her own delegates.

The Imperial Conference of 1926 recognized and clearly stated the now existing relations between Great Britain and the Dominions. The famous Declaration of Equality states that Great Britain and the Dominions are "autonomous Communities within the British Empire, equal in status, in no way subordinate one to another in any respect of their domestic or internal affairs, though united by a common allegiance to the Crown, and freely associated as members of the British Commonwealth of Nations." Five years later, in 1931, the British Parliament passed the Statute of Westminster, designed to give effect to the resolutions of 1926. The statute removed the last check on the Dominions' legislative powers. In 1949 the word "Dominion" was dropped by the government departments of Canada, anticipating formal legislation to abolish use of the term.

World depression during the 1930's, when the Conservative leader, Richard Bedford (later Viscount) Bennett, became Prime Minister (1930–35), interrupted foreign trade. Canadian wheat sold at its lowest price in three centuries, factories closed, the unemployed roamed the country, and dust storms on overplowed farmlands increased distress. As a defense against depression and the high Hawley-Smoot tariff of the United States, an Imperial Conference in Ottawa in 1932 drew up a series of agreements to promote trade among the Dominions. In 1936 Canada and the United States concluded the first Reciprocity Treaty in 70 years, lowering tariffs on many products.

The Rise of New Political Parties

In the depression that followed the first World War new political parties arose to contest the supremacy of the Liberals and the Conservatives (now called Progressive Conservatives). Most influential of several is the Co-operative Commonwealth Federation (C.C.F.), started in Saskatchewan as a loose combination of farmers, socialists, and city labor leaders. It advocates government ownership of banks, industries, and public services; planned production directed by an economic advisory board; national low-cost housing; and encouragement of all forms of co-operation. It has adherents in the other provinces, and many of its reforms have been adopted.

The radical Social Credit party has remained largely confined to Alberta, where it originated under the leadership of William Aberhart. The Labor Progressives are a rebirth of the old Communist party. In Quebec are the Quebec Nationalists and the Bloc Populaire, an extreme isolationist group.

The Second World War

Mackenzie King became prime minister again in 1935. Events were now leading rapidly toward a

second World War On Sept 10, 1939, Canada declared war on Germany All men and women over 16 years of age were registered for war service Military service for home defense was compulsory Mackenzie King pledged himself not to ask for conscription for overseas duty But in a plebiscite held in 1942 all the provinces except Quebec supported overseas conscription Troops for the Europe in battlefronts, however, continued to be raised by voluntary enlistments until 1944 In December of that year it became necessary to draft 16 000 men from the home defense forces to reinforce the hard pressed army overseas Scattered riots throughout the Dominion recalled the draft riots of 1917

Canadian Fighting Record

During the battle of the Atlantic, Canadian convoys carried reinforcements and supplies to England Canada s ships aided in the evacuation of Empire troops from Dunkirk and Greece Within a few hours of the attack on Pearl Harbor, in December 1941 Canada declared war on Japan Japanese residents on the west coast were moved inland and troops were sent to British Columbia to repel possible invasion Canadian troops and airplanes joined the United States in the defense of Alaska When the British garrison at Hong Kong was captured by the Japanese, Canada lost 1 985 men The same number of Canadians was lost in the invasion of Sicily two years later In the raid against German-occupied Dieppe in 1942, over half of the 5 000 Canadians who participated failed to return The First Canadian Army under the command of Lieut Gen H D G Crerar, was on the left flank of the Normandy landings At Arnhem in the Netherlands, Canadian paratroops fought one of the war s bitterest engagements

CANADIAN-SCOTTISH REGIMENT IN LONDON

Canadian troops march over Westminster Bridge toward the House of Parliament in London. These men and their comrades played an important part in the winning of the second World War

The armed forces totaled about 750 000 Canada suffered 102 954 casualties including 37,964 dead and 2 866 missing The Royal Canadian Air Force lost 14 247, the navy, 1 911

Co operation with Empire and the United States

Under the British Commonwealth Air Training Plan, air force units were sent to Canada for training The government paid half the cost Great Britain Australia and New Zealand paid the rest Up to 1945, when the program was discontinued 224 296 men were trained 163 797 of them Canadians One fourth of Britain s R A F fliers were Canadians

Canada and the United States worked closely together in the defense of North America and the production of war matériel Prime Minister Mackenzie King and President Roosevelt in August 1940 met at Ogdensburg N Y, to sign an agreement creating the Permanent Joint Board on Defense Canada made its airports available to American planes and permitted construction of the Alaska (Alcan) Highway, providing an interior route to Alaska Joint War Production Committees and Joint Economic Committees coordinated the resources of the two nations

Production of Canadian industry almost tripled Canada s armed forces needed only about 30 per cent of the huge output The rest was sold or contributed to the other United Nations under the Mutual Aid Fund similar to the Lend Lease Act of the United States During the war Canada gave Great Britain about 5½ billion dollars in gifts mutual aid interest-free loans and canceled debts In 1945 it loaned Britain an additional 1¼ billion dollars free of interest until the year 1951

The war made clear Canada's growing importance as a sovereign nation It took part in the Bretton Woods and San Francisco conferences and in the sessions of the United Nations

Postwar Problems

Mackenzie King resigned from office in 1948 after nearly 25 years of service Louis Stephen St Laurent replaced him as prime minister and leader of the Liberal party (*see* King St Laurent) In 1949 Newfoundland entered the nation as the tenth province That same year Canada signed the North Atlantic Treaty

The last restrictions on its sovereignty were ended in 1949 when Canada gained the right to amend its own constitution instead of submitting it to the British Parliament The Supreme Court of Canada also replaced the Privy Council in England as the final court of appeals in 1950

Also in 1950 Canada and the United States agreed to pool their defense programs Canadian forces joined the United Nations in Korea Canada and other Commonwealth nations formulated the Colombo Plan at Colombo, Ceylon to develop Asiatic countries In 1951, Princess Elizabeth toured Canada The next year, Vincent Massey became the first Canadian born governor general Canada also informed the United States that it would construct the St Lawrence Seaway project alone In 1953, Prime Minister St Laurent and President Eisenhower exchanged visits to discuss common problems Later in the year, New York was authorized to join Canada in a power project on the St Lawrence River

REFERENCE-OUTLINE FOR STUDY OF CANADIAN HISTORY

I. Prehistoric times: Indians cross from Asia over Bering Strait I-89-91, 108e (Eskimos E-396)

II. Discovery and early exploration C-95-95a, A-187, map A-189: the "Beardmore Viking" C-95
- A. Later Vikings reach the New World N-294-6, C-95: Leif Ericson E-391, picture A-187
- B. Early Indian tribes C-95, maps I-91, 106f, table I-107-8: Eastern Woodland I-99; Mackenzie-Yukon Caribou Hunters, I-94; Northwest Fishermen I-94, 106c; Eskimos E-393-7
- C. Rediscovery by John Cabot (1497) C-95-95a, C-8-9, N-139: sights Cape Breton C-118
- D. Search for a Northwest Passage A-190, C-95a: Henry Hudson H-437; Frobisher and Davis A-190, P-348, table P-349
- E. Basis of French claims in North America A-190-1, C-95a: Jacques Cartier C-129-30

III. Founding of New France C-95a-b, A-190-1
- A. Champlain at Port Royal and Quebec C-95a, N-308-9, C-185, pictures Q-10, C-95b
- B. Maisonneuve founds Montreal C-95a, M-380-1
- C. *Habitants* (French farmers) C-95a-b, Q-4
- D. Government C-95b: Frontenac F-301
- E. Mississippi and Great Lakes region explored A-191, M-307, G-185: Marquette and Joliet M-99, J-362; La Salle L-104-5; Hennepin H-334
- F. Cadillac founds Detroit D-75, C-10
- G. Early fur trade F-322-4: Hudson's Bay Company C-95b, H-438, M-80, picture C-96

IV. French and British conflict C-95b-96, chart H-369
- A. British claims N-140, N-309: Acadia A-6
- B. The first intercolonial wars: King William's War K-47; Queen Anne's War Q-11; King George's War K-46
- C. The final conflict—the French and Indian War F-285, S-107, A-6: Wolfe wins Quebec W-181, M-378; Canada ceded to Britain by the Treaty of Paris (1763) C-96, S-107

V. A century of British rule C-96-100
- A. American loyalists (Tories) settle in Canada C-96, N-138b, N-309, O-387, P-412, S-18
- B. Exploring the West C-96-8, M-15, M-80
- C. War of 1812 W-11-14, C-97, O-387, T-155
- D. Canada-United States border treaties G-184, V-437, M-56, T-227, maps U-378, N-230
- E. Struggle for self-government C-97-8, M-15, P-71, B-20
- F. Effect of American Civil War C-98-9, 100, C-332
- G. Founding the Dominion C-99, M-6, T-210

VI. Dominion and expansion C-99-100
- A. British North America Act of 1867 creates the Dominion of Canada C-99
- B. John A. Macdonald's first Conservative government (1867–73) C-99, M-6
  1. Rupert's Land purchased from Hudson's Bay Company (1869) C-99, H-438; Louis Riel and Red River Rebellion R-88, C-99-100; Manitoba becomes a province C-100, M-80
  2. Relations with the United States C-100, C-89
  3. Canada reaches the Pacific C-100: British Columbia enters the Dominion B-317
  4. Struggles to build a continental railway: scandal overthrows Conservatives C-100
- C. Alexander Mackenzie's Liberal government (1873–78) C-100: North West (later Royal Canadian) Mounted Police C-100, R-96
- D. Conservatives restored to power (1878)—Macdonald's policy C-100: Canadian Pacific Railway C-100 (Strathcona S-425, picture C-101); rebellion in Saskatchewan C-100; Bering Sea controversy C-101
- E. Wilfred Laurier's long Liberal administration (1896–1911) C-101-2, L-138
  1. Immigrants settle Prairie Provinces C-101: Alberta A-144; Manitoba M-81; Saskatchewan S-49
  2. Gold discovered in Klondike and Yukon C-101: Yukon separated from Northwest Territories Y-348; Alaska boundary dispute R-222, C-101
  3. Relations with the United States C-101: reciprocal trade agreements C-101 (Laurier supports L-138, Borden opposes B-252)
- F. Robert Borden forms a Conservative government (1911–20) C-102, B-252-3
  1. World War I C-102, B-252-3, H-439: Ypres W-223; Vimy Ridge W-226; Passchendaele W-227; Amiens W-230; Cambrai C-102
  2. Suffrage extended to women (1918) W-185

VII. Between two World Wars C-102, chart H-369
- A. Progress toward self-government C-102: Mackenzie King, Liberal prime minister K-44-5
- B. The depression years C-102, S-49, A-144, K-44
- C. New political parties C-102: socialism in Saskatchewan S-48, 49; Social Credit in Alberta A-144; social laws in British Columbia B-317
- D. Statute of Westminster (1931) recognizes autonomy of all British Dominions C-91, C-102, B-319
- E. Trade agreements with the United States C-102

VIII. World War II C-102-3, W-248
- A. Canada and United States establish Permanent Joint Board on Defense C-103, R-213, W-253
- B. Industry expands to meet war needs C-89, C-103
- C. Alaska (Alcan) Highway C-103, Y-348, R-158
- D. Campaigns and leaders C-103, picture W-271: D-Day W-280; St. Lô and Falaise-Argentan W-281, picture W-281; drive through Germany W-282, 284

IX. The postwar period C-103, chart H-369
- A. Federal District of Ottawa created in 1945 O-429
- B. Bretton Woods and San Francisco Conferences—Canada joins the United Nations C-103
- C. St. Laurent replaces Mackenzie King as prime minister and leader of Liberal party C-103, S-18
- D. Newfoundland, together with Labrador, becomes the tenth province N-139, L-76
- E. Last formal ties with Great Britain cut—term "dominion" dropped C-91; British Privy Council replaced by Canada's Supreme Court C-91, 103
- F. Canadian forces fight in Korea (1950–53) C-103
- G. Vincent Massey, first Canadian-born governor general, succeeds Alexander C-103
- H. St. Lawrence Seaway Project approved by the United States E-287d

(For bibliography, see Canada.)

POETRY *and* PROSE *by* CANADIAN WRITERS

CANADIAN LITERATURE In Canada, as in the other countries of the Americas, literature slowly catches up with history. For more than 300 years after the French and English first landed on Canadian shores, men were occupied with giant tasks. They civilized and unified a vast and rugged land, and they advanced steadily to political independence. In the meantime Canadian writing has slowly approached maturity. Today there is a distinctive Canadian literature which has many examples of beauty and originality. Some of these achieve true greatness.

With a wilderness to conquer in Canada's early days, there was little time for creating literature. Explorers traced the courses of Canadian rivers and forest trails. Missionaries went out among the Indians and sometimes they were burned at the martyr's stake. Fur trappers and traders sought valuable pelts. Soldiers built forts and later settlers cleared lands for farms. These men were making history, and the records of their adventures and achievements are rich mines of information and sources of wonder.

The journals of Cartier and Champlain tell of the powerful feelings aroused by the New World, which, Champlain wrote, was 'beautiful even to perfection." The records of the Jesuit missionaries describe a land established "to the glory of God, the honor of the King, the welfare and good repute of the Mother Country." Marie de l'Incarnation, founder of the Ursuline Convent in Quebec, wrote down practical details of founding hospitals and schools in the wilderness. With these she also set down reflections of her religious faith.

These journals, written in French by people born and educated in France and intended to be read in France, did not start a Canadian literature. Modern Canadian writers, however, have drawn from these rich materials. For example, 'The Champlain Road' (1939), a novel by Franklin Davey McDowell, and 'Brebeuf and His Brethren' (1940), an epic poem by Edwin John Pratt, are imaginative tales based upon facts from these records.

The Twin Cultures of Canada

The early French Canadians had two main interests—to gain wealth and to win souls for God. They soon saw that furs could bring quick and immense profits. The roving traders and trappers did not settle in communities. Both they and the missionaries lived largely among the Indians. Thus under the French, Canada grew very slowly. When the French surrendered to the British in 1759, a new era in national growth began (*see* Canadian History). New Englanders moved northward, immigrants came from Britain. After the American Revolution, nearly 40,000 Loyalists migrated to British North America. They settled mainly in the maritime colonies and in Upper and Lower Canada, now the provinces of Ontario and Quebec.

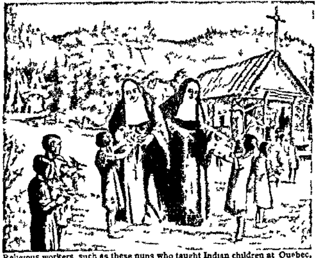
In spite of their military defeat by the British the French did not assume the role of a conquered people. They had fought valiantly with inferior forces and scant aid from France. In triumphant defeat they became political subjects of Britain but continued to develop their own French Canadian way of life. Today in the province of Quebec the French language prevails, and a distinctive French Canadian attitude far removed from Old World France can be seen. The rest of Canada is predominantly Anglo Saxon in thought and English in language.

Start of Canadian Literature in English

In the beginning most English speaking Canadian writers leaned heavily on what they learned from British books. Journals and letters were the popular literary forms and Canadian life and scenery the subjects. Sir Alexander MacKenzie's Voyages from Montreal through the Continent of North America (1789–93) and the epic of pioneer life Roughing It in the Bush' (1852) by Mrs Susanna Moodie are examples of this type of writing. The first real novelist John Richardson, wrote an Indian tale Wacousta (1852), using similar materials as a background.

The first truly notable book in Canadian literature was 'The Clockmaker, or the Sayings and Doings of Samuel Slick of Slickville', published in Halifax in 1836. The author was Thomas Chandler Haliburton, a Nova Scotia judge. With a masterly command of dialogue, Haliburton created the character of a Yankee clock peddler. Smart and aggressive Sam Slick is in sharp contrast to the indolent and naïve Nova Scotians with whom he deals. Even for today's readers he holds interest.

CANADA'S PAST INSPIRES MODERN WRITERS



Religious workers such as these nuns who taught Indian children at Quebec, left records of their work which have inspired modern Canadian writers

One more outstanding novel was published before the end of the 1800's—'The Golden Dog' (1877), a historical novel set in Quebec during the 1700's. It was written by the British-born William Kirby. During this time Sir Gilbert Parker's novels were immensely popular (*see* Parker).

Confederation Brings New Productivity

The British North America Act of 1867 united the provinces of Nova Scotia, New Brunswick, Quebec, and Ontario. It also provided for the eventual inclusion of all British North America. With confederation came stirrings of national pride. The growing self-confidence and fresh awareness of the beauty of the land became themes for literature.

'Orion', the first collection of poems by Charles G. D. Roberts (later Sir Charles Roberts), was published in 1880. It was the "first flowering" of Canadian poetry. Later Roberts said: "When I was beginning to write I was not aware of any such thing as Canadian literature but I did dream of starting a Canadian literature and I joyously hailed the first efforts of Lampman and Carman as the beginning of it."

Roberts, Bliss Carman, Archibald Lampman, and Duncan Campbell Scott are four poets whose works mark a "golden age" in Canadian literature. Carman helped start the revolt against the popular pale and bookish poetry. Much of his own verse ('Songs of Vagabondia') glows with an outdoor healthiness.

Ontario-born Archibald Lampman was dramatically won over to the new Canadianism by Roberts' 'Orion', which he said he read "in a state of the wildest excitement." It was a call for him to be at work. In the Canadian woods he found peace and a refuge from his dull labors as a civil servant. Here also he found themes for his nature poems, such as 'Heat':

On the brook yonder not a breath
Disturbs the spider or the midge
The water-bugs draw close beneath
The cool gloom of the bridge.

Duncan Campbell Scott found his subjects in the harshness of nature, in Canada's cold and snowbound winters, and in the gloom and solitude of its forests. Some of his best poetry is about Indians, whom he knew from his work in the Federal Department of Indian Affairs. In contrast to his realistic writing are his "dream" pieces, such as 'The Piper of Arll'. John Masefield called it the first poem by a living writer to touch him deeply. Scott was also a skilled short-story writer. 'In the Village of Viger' is a fine interpretation of French Canadian life.

Other poets of the period won attention by the popular appeal of their work. Isabella Valancy Crawford, in 'Malcolm's Katie', drew a good poetic image of backwoods life in Ontario. The success of William Henry Drummond's 'The Habitant' was partly due to his skill in handling French Canadian dialect. This was resented by some champions of pure French, but it effectively translated the simple life of farm and village into verse (*see* Drummond). The poetry of Robert W. Service has vigor, adventure, and human interest. and it has won a wide audience. Edward Killoran Brown said of Service: "He caught a noisy, highly colored moment in our history—the Yukon gold rush—in his noisy, highly colored verse."

Nature and its wild creatures were subjects for a major Canadian contribution to literature—the animal stories of Charles G. D. Roberts and Ernest Thompson Seton. Seton, however, wrote some of his best work while living in the United States.

French Canadian Literature in the 1800's

Against the accusation that the French Canadians were a "people with no history," François-Xavier Garneau vindicated his people with the first volume of his 'Histoire du Canada' (1845). This notable work inspired what is now called the "Quebec School" of French Canadian literature. Another inspiration came as a result of the Crimean War. France and Britain. long at odds, joined forces; and French Canadians hailed the renewed contact with France. Under this double inspiration Octave Crémazie wrote stirring patriotic verse proclaiming French Canadian loyalty to the ideals of France. Louis-Honore Fréchette won the Prix Montyon of the French Academy in 1880 for his poems 'Les Fleures boreales; les oiseaux de neige' (Flowers of the north; birds of the snow). This recognition from France gave French Canadian poets new confidence. Fréchette later wrote a national epic, 'La Légende d'un peuple' (1887). It is generally pompous in style, but with many fine passages of simple description and characterization.

Léon-Pamphile Le May used the sonnet form, 14 lines long, to write of his countrymen's historic deeds. portraits, and customs. Monsignor Camille Roy said of Le May's collection of 182 sonnets: "If ever our people should lose their family, national, and religious traditions, they can all be found again in 'Les Gouttelettes' [Tiny drops]."

At 74 Philippe Aubert de Gaspé began to write his first romance 'Les Anciens Canadiens' (1863). Not ranked as a major literary work, nor even to be classed as a novel, it is nonetheless a good first-hand record of life in early French Canada.

These writers often turned to France's glorious past. The generation that followed turned to the France of their own day. In 1895 a group of young men in Montreal started a new literary movement. Influenced by the French writers Hérédia and Leconte de Lisle, they adopted a highly personal approach to experience. From the movement came two poets of genius. Before he was 19, Emile Nelligan had pointed the way to a new poetry of the heart. Albert Lozeau. a shut-in for most of his life, let his mind wander free to gather imaginary experiences in love, music, and nature. A little later came Paul Morin. His first volume of poetry, 'Le Paon d'émail' (The enamel peacock) is the most brilliant though least Canadian of the group.

Bridging the Two Cultures

Poetry reaches only a small audience, and its translation is rarely satisfactory. Thus Canada's two language groups knew little of each other's poetry. The rise of the novel, however, helped bridge the

gap between the two literatures for most novels can be effectively translated The first such bridge was the novel 'Maria Chapdelaine', written by the French Canadian Louis Hémon and translated into English by W H Blake In this simple picture of a French Canadian farm the round of daily tasks and ordinary events are made important by deeply felt emotions It is a regional novel with universal appeal

As the Dominion expanded from coast to coast novels about various regions became popular Lucy M Montgomery placed Anne of Green Gables' a story of girlhood in her native Prince Edward Island Charles W Gordon using the name ' Ralph Connor,' caught the fervor of pioneer religious missions in his many novels William O Mitchell in Who Has Seen the Wind , used the wind swept Saskatchewan prairies as the setting for a story of boyhood

Some Canadian novelists sought to express life in acutely realistic narratives One of these writers was Frederick Philip Grove He was probably the first Canadian to try to earn his living by creative writing His stories tend to be morbid but he persistently probed beneath the surface of life He gave Canadian fiction a strong push in the direction of realism and philosophical analysis 'In Search of Myself is an account of his life as a writer

Morley Callaghan was one of the young writers from several countries who lived in Paris after the first World War Callaghan returned to his native Toronto and used Canadian cities for his settings but his writing shows little Canadian influence Now that April's Here' represents him at his best

Writing for a wider reading public Mazo de la Roche won the Atlantic Monthly prize in 1927 for her novel 'Jalna' The charming Jalna story now runs through numerous novels set in the Ontario country side, but with a strangely British atmosphere Her drama 'Whiteoaks', from one of the Jalna novels, was a stage success in London and New York City

The novelist who has perhaps treated Canadian topics best is Hugh MacLennan In 'Two Solitudes' he deals with the problems and hopes of achieving French English understanding in Canada Thomas Raddall's long familiarity with the sea gives his writing a robust freshness He began with historical fiction ('His Majesty's Yankees) but turned to the modern scene in 'The Nymph and the Lamp'.

Three modern French Canadian authors are widely read in English translation Roger Lemelin in his novels of Lower Town Quebec and Gabrielle Roy, in her Montreal story 'The Tin Flute', depicted city life in French Canada In Gabrielle Roy s 'Where Nests the Water Hen', the setting is northern Manitoba, where church and home are still the central influences Germaine Guèvremont s trilogy, 'The Outlander', is set in an isolated village on the St Lawrence River It pictures the influence of an outsider who comes to live among the simple villagers

Modern Poetry in English

One much quoted Canadian poem came out of the first World War—John McCrae's 'In Flanders Fields'

SAM SLICK SELLS A CLOCK

Thomas Chandler Haliburton's stories of Sam Slick Yankee clock peddler, were immensely popular in the middle 1800 s

Like their American and British contemporaries the poets after the war became highly experimental individual, and sometimes obscure Richness of feeling—revolt or passion, faith or disdain—marks all their work Distinctively Canadian is Anne Marriott s 'The Wind Our Enemy', dealing with the prairie drought So is Earle Birney's 'David', a narrative poem of mountaineering Birney's war poems and his novel 'Turvey' are true expressions of a Canadian's reaction to the second World War

Another group of poets are less concerned with expressing a conscious Canadianism in their work For example, Leo Kennedy s vibrant emotional verse often echoes the poetry of T S Eliot Francis R Scott shows a deep feeling for social responsibility in his poems Arthur J M Smith s subjects range through religion politics and nature all treated with intensity and outstanding craftsmanship Abraham M Klein deals with Jewish themes past and present as in 'Hath Not a Jew'.

Following no trend and belonging to no literary group, Edwin J Pratt stands out as a great narrative poet He was born in Newfoundland where he knew the surge of the sea and its life After some early poetry, he revealed his full powers in the volume 'Titans'. He rejoices in the strength of nature In 'The Cachalot' it is the strength of a whale In 'The Titanic', after due tribute to man's heroism, he ends with a tribute to the iceberg His work has boisterous humor, and it abounds with sounding words that contribute to the rush of the action His recent

narrative 'Towards the Last Spike' tells of the building of the Canadian Pacific Railroad.

Canadian Humor

Little humor has crept into Canadian writing, with few notable exceptions. Stephen Leacock in 'Literary Lapses' and other volumes of nonsense has fastened on the absurdities of common things. His 'Boarding House Geometry', 'A, B, and C', and similar pieces have provoked laughter in many corners of the world. John D. Robins has satirized summer vacations in 'The Incomplete Anglers' and 'Cottage Cheese'.

Another satirist is Robertson Davies, who points wittily and forcefully at what he considers the low state of Canadian culture. His 'Diary of Samuel Marchbanks', his plays, and his novel 'Tempest-Tost', though somewhat snobbish, have a light touch and an elegant manner. Davies is the leading Canadian dramatist in a field where there is little competition.

Representative Canadian Writers

THE FRENCH REGIME

Cartier, Jacques (1491–1557), explorer—'Voyages de Jacques Cartier au Canada en 1534'.

Champlain, Samuel de (1567–1635), explorer—'Les Voyages de la Nouvelle-France occidentale dicte Canada faits par le Sr. de Champlain depuis l'an 1603 jusqu'en l'an 1629'.

Gagnon, Ernest (1834–1915), editor—'Chansons populaires du Canada'.

Marie de l'Incarnation, vén. Mère (1599–1672)—'Lettres spirituelles et historiques'.

Relations des Jésuites.

THE BRITISH COLONIAL PERIOD

Crémazie, Octave (1827–79), poet—'Poésies'.

Garneau, François-Xavier (1809–66), historian—'Histoire du Canada'.

Gaspé, Philippe Aubert de (1786–1871), novelist—'Les Anciens Canadiens'.

Gerin-Lajoie, Antoine (1824–82), novelist—'Jean Rivard'.

Haliburton, Thomas Chandler (1796–1865), humorist and historian—'The Clockmaker, or the Sayings and Doings of Samuel Slick of Slickville'; 'Historical and Statistical Account of Nova Scotia'.

Heavysege, Charles (1816–76), poet—'Saul, a Drama in Three Parts'.

Moodie, Susanna (1803–85), essayist—'Roughing It in the Bush'.

Richardson, John (1796–1852), novelist—'Wacousta'.

Sangster, Charles (1822–93), poet—'Hesperus and Other Poems'.

WRITERS OF THE NEW DOMINION

Carman, Bliss (1861–1929), poet—'Low Tide on Grand Pré'; 'Poems'.

Crawford, Isabella Valancy (1850–87), poet—'Old Spookses Pass, Malcolm's Katie and Other Poems'; 'Collected Poems'.

Drummond, William Henry (1854–1907), poet—'The Habitant and Other French Canadian Poems'.

Fréchette, Louis-Honore (1839–1908), poet—'Feuilles Volantes'; 'La Légende d'un peuple'.

Johnson, Pauline (1862–1913), poet—'Flint and Feather'.

Kirby, William (1817–1906), novelist—'The Golden Dog'.

Lampman, Archibald (1861–99), poet—'Among the Millet'; 'Selected Poems'.

Le May, Léon-Pamphile (1837–1918), poet—'Les Gouttelettes'.

Pickthall, Marjorie (1883–1922), poet—'A Drift of Pinions'; 'The Wood-Carver's Wife'.

Roberts, Sir Charles G. D. (1860–1943), poet and nature writer—'Orion'; 'Selected Poems'; 'Kindred of the Wild'.

Saunders, Marshall (1861–1947), novelist—'Beautiful Joe'

Scott, Duncan Campbell (1862–1947), poet and short-story writer—'Selected Poems'; 'In the Village of Viger'.

Service, Robert W. (born 1876), poet—'Songs of a Sourdough'.

Seton, Ernest Thompson (1860–1946), nature writer—'Wild Animals I Have Known'.

THE LITERATURE OF MODERN CANADA

Birney, Earle (born 1904), poet, short-story writer, and novelist—'The Strait of Anian'; 'Turvey'.

Bruchési, Jean (born 1901), historian—'Histoire du Canada pour tous' (translated as 'A History of Canada').

Callaghan, Morley (born 1903), novelist and short-story writer—'Now That April's Here'; 'The Loved and the Lost'.

Choquette, Robert (born 1905), poet and novelist—'A Travers les vents'; 'Les Velder'.

"Connor, Ralph" (Charles W. Gordon) (1860–1937), novelist and biographer—'Black Rock'; 'Postscript to Adventure'.

Creighton, Donald G. (born 1902), historian—'Dominion of the North'.

Davies, Robertson (born 1913), playwright, humorist, and novelist—'Eros at Breakfast'; 'Diary of Samuel Marchbanks'; 'Tempest-Tost'.

De la Roche, Mazo (born 1885), novelist and playwright—'Jalna'; 'Whiteoaks, a Play'.

Des Rochers, Alfred (born 1901), poet—'A l'Ombre de l'Orford'.

Finch, Robert (born 1900), poet—'Poems'; 'The Strength of the Hills'.

Graham, Gwethalyn (born 1913), novelist—'Earth and High Heaven'.

Grove, Frederick Philip (1872–1948), novelist, short-story writer, and biographer—'Fruits of the Earth'; 'Over Prairie Trails'; 'A Search for America'.

Guèvremont, Germaine (born 19—?), novelist—'Le Survenant; Marie Didace' (translated as 'The Outlander').

Hardy, W. G. (born 1896), novelist—'All the Trumpets Sounded'; 'The Unfulfilled'.

Hébert, Anne (born 19—?), poet—'Les Songes en équilibre'.

Hémon, Louis (1880–1913), novelist—'Maria Chapdelaine'.

Hiebert, Paul (born 1892), humorist—'Sarah Binks'.

Hutchinson, Bruce (born 1901), essayist and historian—'The Unknown Country'; 'The Fraser'.

Kennedy, Leo (born 1907), poet—'The Shrouding'.

Klein, Abraham M. (born 1909), poet and novelist—'Hath Not a Jew'; 'The Rocking Chair and Other Poems'.

Lamontagne, Blanche (born 1889), poet—'Ma Gaspésie'.

Leacock, Stephen (1869–1944), humorist—'Sunshine Sketches of a Little Town'; 'Literary Lapses'.

Lemel n Roger (born 1913 no el t Au P ed de la pente dou e (an lated as The To n Below) Les Plouffe (tran lated as 'The Plouffe Fam ly

Lower A R M (born 1889 histor an Colony to Nation

Lozeau Albert (1878 1924 poet—'Lauriers et feuilles d erable

McA thur Peter (1866 1924 humori t— In Pastures Green

McC ae John (18 2 1918) poet In Flanders F lds and Other Poems

MacDonald W lson (born 1880 poet Out of the Wil derness

McDowell Frankl n Davey (born 1898) novel t 'The Champlain Road The Forges of Freedom

MacLennan Hugh (born 1 0 nove is and es ayist— Barometer Ris ng Two So tudes

Ma chand Clement (bo n 1912 poet Les So rs rouges

Mar ott Anne (born 1913 po — The Wind Our Enemy

M tchell W l'am O (born 1914 nove and short-story writer— Who Has Seen the Wind

Montgomery Lucy M (18 4 1942 no elist— Anne of Green Gables

Morin Paul (born 1889) poet— Le Paon d ėma l Poėmes de cendre et d or

Nell gan Em le (1882 1912) poet— Emile Nell gan et son oeuvre

Pacey Desmond (born 1917) crit c— A Book of Canad an Sto es Creat ve Writ ng n Canada

Pratt Edw n J (born 1883) poet— Brebeuf and H s B ethren Collected Poems Toward the Last Sp ke

Raddall Thomas H born 1903) novelist and his o-rian 'The Nymph and the Lamp Halifax

R nguet (**Ph l ppe Panneton**) (born 1895) novelist— 30 Arpents (t anslated as Thirty Ac es)

Rob ns John D born 1884) humorist—'The Incomplete Angl rs Cottage Cheese

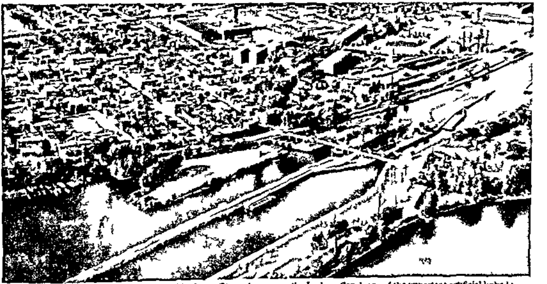
Roy Gab elle (born 19—?) novelist Bonheu d oc cas on (t anslated as The T n F ute) La pet e poule d eau (translated as Whe e Nests the Wa e H n

Salve son Lau a Goodman (born 1890) novelist Confes ons of an Immigrant s Daughter

Slater Pat ck (John M tchell) (1880–1951) novelist — The Yellow Bria

Sm th Arthu J M (born 1902) poet and cri c— News of he Phoenix 'The Book of Canadian Poetry (edito)

Man-Made CANALS *and Their* MANY USES



Above Montreal Canada lies the city of Lachine Th ough passes the Lachine Canal one of the important artificial links in the St. Lawrence wa erway The canal was built to bypass the swift Lachine rapids No e the lo ks jus above the bridge

CANALS The art ficial channels that connect natural bod es of water are called canals Men also d g canals to drain low areas to float away sewage and to bring water to dry farmlands Some canals carry water from storage places (*reservo s*) to c ty water supply systems Other canals provide a swift flow of water to make electric ty at hydroelectr c plants Canals are also built as detours in rivers These canals allow r ver boats to avoid waterfalls rap ds and dams

The most important are the *na igation* canals that connect or take the place of natural bod es of water These may e ther be *sh p* or *barge* canals Most sh p canals are deep and w de They can carry all but the very deepest and widest ships Barge canals ca ry only shallow boats usually flat-bottomed barges In some navigat on canals the water keeps flowing from the source to the mouth In others the water is confined and still Ships and boats sometimes move through canals under the r own power Sometimes they are towed by tugs or by small locomot ves running on ra ls along the banks In the old days the sh ps or boats were pulled by horses or mules trotting along the banks

Ship canals that link oceans and seas shorten the distance between many ports by thousands of miles. This makes them important in trade between countries. In wartime these ship canals are well protected because warships, transports, and supply ships must pass through them. The Suez Canal, that links the Mediterranean and the Red seas, and the Panama Canal, that provides a "short cut" between the Atlantic and Pacific oceans, are notable examples (*see* Panama Canal; Suez Canal).

The Kiel Canal in Germany connects the Baltic and the North seas. It saves ships a long journey around Denmark. The Baltic-White Sea Canal was built by Russia. Ships traveling between Leningrad and Archangel use it instead of making the 2,800-mile trip around the Scandinavian peninsula. The twin canals of Sault Sainte Marie, which connect Lake Superior and Lake Huron, carry more freight than any of the canals that link oceans and seas.

Water Stairways for Ships

When two natural bodies of water stand at different levels, building a canal between them presents a complicated engineering problem. To make up for the difference in level, engineers build one or more water "steps," called locks, that carry ships or boats up or down between the two levels.

A lock is an artificial water basin. It has a long rectangular shape with concrete walls and a pair of gates at each end. When a vessel is going upstream, the upper gates stay closed as the ship enters the lock at the lower water level. The downstream gates are then closed and more water is pumped into the basin. The rising water lifts the vessel to the level of the upper body of water. Then the upper gates open and the ship passes through. For downstream passage, the process works the opposite way. The ship enters the lock from the upper level, and water is pumped from the lock until the ship is in line with the lower level. A lock may be large enough to hold two or more ships or boats.

Often the difference in levels is so great that a series of locks are needed. They may be connected to one another or may be spaced at intervals along the canal. Sometimes a series of locks are built so that ships "climb" up one side of a ridge and down the other. The Panama Canal lock system was built for this purpose. (For a diagram of how locks work, *see* Panama Canal.)

Straightening or deepening rivers and building locks in them where needed is called *canalizing*. About 24,000 miles of rivers in the United States have been canalized, and the work is still going on.

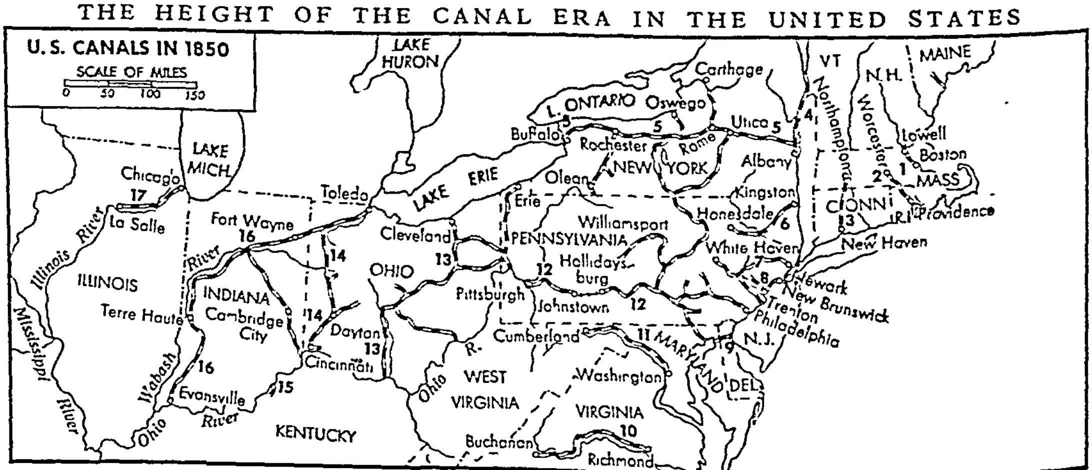
Drainage canals present special building problems. They must be dug so that they slope evenly from the area to be drained to the place where the water empties. If the canal passes through rolling country, the canal bottom and banks may have to be built even higher than the surrounding lowlands.

If the canal is dug through soft earth or sand, it gradually fills in and then, to keep it open, it must be cleaned out, or *dredged*. Water flowing swiftly through a canal, as in a canal that furnishes water power for making electricity, tends to "scour" the bottom and sides. This widens and deepens the canal, and the flow of water slows down.

Canals in Asia and Europe

Ancient Greek historians tell of a canal dug by the Egyptians to join the Nile River and the Red Sea, but

THE HEIGHT OF THE CANAL ERA IN THE UNITED STATES



1. Middlesex Canal
2. Blackstone Canal
3. New Haven and Northampton Canal
4. Champlain Canal
5. Erie Canal
6. Delaware and Hudson Canal
7. Morris Canal
8. Delaware and Raritan Canal
9. Chesapeake and Delaware Canal
10. James River and Kanawha Canal
11. Chesapeake and Ohio Canal
12. Pennsylvania Main Line Canal
13. Ohio and Erie Canal
14. Miami and Erie Canal
15. Louisville and Portland Canal
16. Wabash and Erie Canal
17. Illinois and Michigan Canal

This map shows how artificial and natural waterways combined to provide water highways across the most thickly settled portion of the United States in the middle of the 19th century. The railroads had hardly begun to extend their network westward, and wagon roads were few and poorly kept. Canals carried cargo and passengers at good speeds and cheap rates for the time. Parts of many of these canals are still in use. The Erie, for example, is part of the New York State Barge Canal.

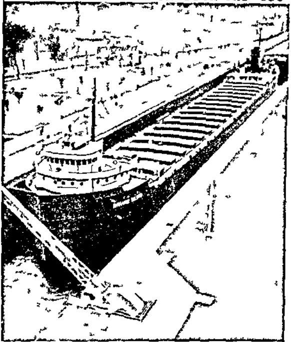
all traces of it have been covered over. Later Nile Red Sea canals were built during the early Christian Era. The best known of these was the Amr. Part of it is still used to carry fresh water from the Nile to the city of Suez on the Red Sea. Other historical records tell of the royal canal of Babylon built by King Nebuchadnezzar in Biblical times to join the Tigris and the Euphrates rivers.

The longest as well as the oldest canal still in existence is the Grand Canal of China. It connects the Pei ho River and the Yangtze Kiang. It may have been started as early as the 5th century B.C. and it was finally finished about A.D. 1280 by Kublai Khan. For centuries the 1,000-mile canal was an important waterway and it also carried water for irrigation.

The Romans were road builders and engineers but they dug few canals. Modern Italy has found little use for canals. About the 8th century Charlemagne planned a system of canals to connect the Rhine, the Main and the Danube rivers.

Locks were already in use by the 1400's. The great Italian Renaissance artist and engineer Leonardo da Vinci built a series of six locks to join the canals of Venice. The pioneer of modern French canals was the Languedoc Canal or Canal du Midi. It joined rivers that flow into the Bay of Biscay on the Atlantic Ocean and those that empty into the Mediterranean Sea. The canal was finished in 1681 under the reign of Louis XIV and was the biggest engineering work undertaken in Europe up to that time. With it France began its plan of inland waterway building which has added about 3,000 miles of canals to its 4,600 miles of rivers open to boats and ships. The present Languedoc Canal is about six and a half feet deep and 148 miles long. It rises to 620 feet above sea level and has 119 locks. (*See also* France.)

LOCKING A FREIGHTER THROUGH THE SOO

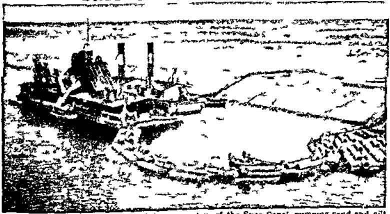


A huge Great Lakes steamship laden with iron ore passes through the McArthur locks at Sault Sainte Marie. The two canals comprising the "Soo" bypass the rapids in the Saint Marys River, permitting lake ships to pass between Lake Huron and Lake Superior.

When the Industrial Revolution started in England during the late 1700's, waterways were needed to carry coal and other bulky goods. For about 75 years Englishmen built many canals, but railroads gradually took their place. The Manchester Ship Canal between Manchester and Liverpool is a good example of how a canal connects an inland city with the sea. This canal, the most important in Britain, makes the great manufacturing city of Manchester a seaport, even though it is 35 miles inland.

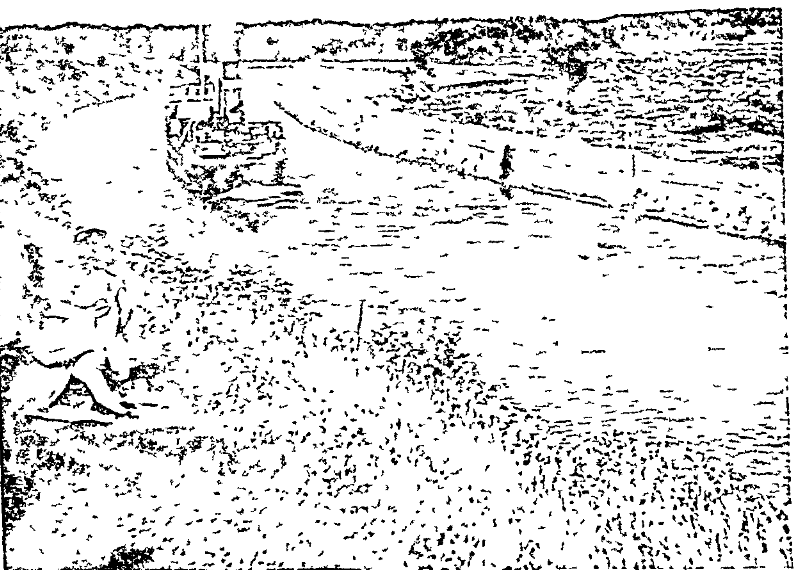
The canal has five sets of locks. Each set has a large and a small lock side by side. The small lock is used for small ships and boats. A swing bridge carries the old Bridgewater Canal, built in 1759, over the modern Manchester waterway. This swing bridge is a steel trough 19 feet wide, 6 feet deep and 234 feet long. It can be closed off from the rest of the overhead canal and swung about on an axis so that ships can pass by in the lower canal.

DREDGING THE SUEZ CANAL



This floating dredge travels up and down a section of the Suez Canal, pumping sand and silt from the canal bottom and depositing it on the banks. This work is needed to keep the canal from filling in. The approximately 100-mile canal runs from Port Said on the Mediterranean to the city of Suez on the Red Sea, passing through lakes and lagoons on its way.

DETOURING AROUND RAPIDS VIA A CANAL



Here on the St. Lawrence waterway a narrow bank separates this placid canal from the rough waters of the rapids. Such canals along the river permit small steamers to travel from Lake Ontario to the Atlantic Ocean. Larger vessels can come inland only as far as Montreal.

Today much of Europe is covered with a network of inland waterways The canals of Holland provide both drainage from the lowlands and transportation (*see* Netherlands). All the larger river systems in north Germany and in Russia are connected. An important Russian canal is the Volga-Don connection, which was completed in 1952. The Russians build navigation canals that also serve as water-power sources for making electricity. In western and central Asia, the Russians have linked river systems with canals so that boats can travel from the Ural Mountains to Lake Baikal in the heart of the continent. (*See also* Germany; Russia.)

The Canal Era in the United States

Canals were a great help in developing the United States. George Washington realized how much help they would be, and he headed the first company formed to build the Chesapeake and Ohio Canal. This canal was not completed until 1850, but several short ones connecting rivers were built in the early days of the United States. The first was dug at South Hadley, Mass , between 1792 and 1796.

Meanwhile the country was expanding westward, and the settlers in western New York, Pennsylvania, and Ohio were faced with the problem of transporting goods. The places to sell their farm products were Philadelphia and New York City. The settlers needed the manufactured goods from these cities also. Wagon freight was too expensive. It cost a hundred dollars to send a ton of freight from Buffalo to New York City and the trip took 20 days. The new flat-bottomed river steamships offered cheap transportation, but there were no through water routes between the eastern cities and the western farmlands.

Canals to link the natural waterways were the answer, but they would have to be much longer than any that had ever been dug before. The cost and the engineering problems made most people think the solution impractical. DeWitt Clinton, governor of New York, thought otherwise. He proposed to dig a canal to connect the Hudson River at Troy and Albany with Lake Erie at Buffalo, 340 miles away. The Federal government would not undertake the job, so he persuaded his state to do it. The Erie Canal, begun in 1817, was completed in 1825 at a cost of more than 7 million dollars.

"Clinton's Ditch," as people scornfully called it, more than lived up to its sponsor's faith. It opened up a huge area to settlement, and it became busy with freight and passenger traffic. The western farmers prospered because of it Land values rose, and goods could be shipped between New York City and the Great Lakes region in eight days at a fraction of the old cost. Relay teams of horses or mules pulled light passenger packet boats through the canal from Buffalo to Albany in three and a half days. Towns along the route grew fast, and New York City was started on its way to becoming the nation's largest city. The Erie Canal was enlarged several times. Finally it became the chief link in the New York State Barge Canal system (*see* New York).

The success of the Erie inspired more canals. One ambitious project was a combined canal and portage railway route through the mountainous country between Pittsburgh and Philadelphia. It was completed in 1834. Travel by this route was slow and expensive, and traffic was never very heavy. Some of the canals were barely finished when the new railroads began to take away their business. For about 50 years people were little interested in canals. Gradually the Federal government began canalizing rivers and building new canals. These now offer cheap transportation for bulky freight loads of such raw materials as coal and such manufactures as automobiles.

Some Important Canals in the United States

Among the important ship canals in the United States are the "Soo" canals at Sault Sainte Marie. These allow vessels to pass between Lake Huron and Lake Superior (*see* Sault Sainte Marie). The Cape Cod Canal was built in 1904–14 across the narrow

strip where Cape Cod joins the mainland of Massachusetts Leading directly from Massachusetts Bay to Buzzards Bay it saves about 70 miles in the trip from Boston to New York City and avoids the storms and treacherous shoals of Nantucket It was bought by the Federal government in 1928 and forms a link in the Intracoastal Waterway

The Intracoastal Waterway is a protected inland water route along the Atlantic and Gulf coasts It goes through various natural bodies of water and old canals such as the Chesapeake and Delaware A vessel can travel inland along the Intracoastal Waterway about 1 500 miles down the Atlantic coast from the Delaware River to Miami Fla and for about 1 000 miles from Apalachicola Fla to Brownsville Tex Water borne freight can travel this distance on barges without being transferred to ocean going ships Canalized rivers have turned Houston Tex 50 miles inland into a busy port for deep water vessels (*see* Houston)

The Illinois Waterway joins the Great Lakes with the Mississippi River and thus with the Gulf of Mexico It was officially opened in 1933 It has a channel 160 to 200 feet wide and nine feet deep From Chicago to Lockport Ill it uses the Chicago Sanitary and Ship Canal (sometimes called the Drainage Canal) This section was completed in 1900 to carry the water of the Chicago River into the Des Plaines River at Lockport and thence into the Illinois River The Chicago River formerly flowed into Lake Michigan polluting Chicago s drinking water with sewage and industrial waste Reversing the flow of the river vastly improved both Chicago s health and its commerce (*see* Chicago Illinois)

Canadian Canals

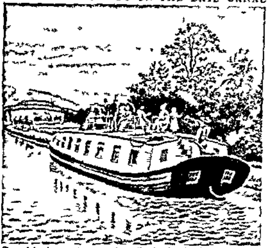
Canada s most important waterway is the St Lawrence system of rivers and lakes stretching from the Strait of Belle Isle to the head of Lake Superior Three important links in this system are the Canadian Sault Sainte Marie Canal the Welland Ship Canal that connects Lake Erie and Lake Ontario and the six canals around the rapids of the St Lawrence River above Montreal

The St Lawrence Seaway a joint United States Canadian project would make the St Lawrence system open to deep-water ships This would permit vessels to travel directly from the Atlantic Ocean to such Great Lakes ports as Chicago and Cleveland Final acceptance of the plan has not yet been reached (*See also* Great Lakes St Lawrence River, Welland Ship Canal)

The Rideau-Ottawa canal system offers safe water travel between Kingston and the lower St Lawrence by way of Ottawa and the Ottawa River Originally it was built mainly for military use and formed a back door between the two rivers The Rideau Canal formed by canalizing the Rideau and Cataraqui rivers and using the Rideau lakes was opened in 1833 It has 47 locks and is about 133 miles long

The Trent Canal connects Georgian Bay the eastern arm of Lake Huron with the Bay of Quinte at the

PASSENGER PACKET ON THE ERIE CANAL



Towed by horses trotting along the bank this Erie passenger boat of the middle 1800 s traveled at five miles an hour Passengers reclined on the cabin roof and went below to eat and sleep

northeast end of Lake Ontario It cuts out the long trip around the V-shaped peninsula of the Province of Ontario that is formed by the two lakes but the canal carries only shallow-draft boats The canal is actually a series of locks and channels in the chain of lakes and rivers between the two bays One of the rivers is the Trent from which the canal gets its name At the Georgian Bay end there is a marine railway instead of locks (Statistics on the world s greatest canals are in a table under **Canals** in the FACT-INDEX)

CANARY BIRD The Canary and Madeira islands are the native haunts of the cheerful little household pet the canary In the wild state this member of the finch family measures about 5½ inches in length It is dull green above with a yellow breast Canaries became cage birds in the 16th century when they were first brought from the Canary Islands to Italy By special breeding no less than 50 varieties have been produced differing greatly in size form and plumage from the r wilderness kin

The raising of roller canaries is an important industry in the Harz Mountains in Germany In breeding this variety all attention is directed to the development of voice Like the prima donnas of the concert stage young rollers (only the males are gifted singers) are trained rigorously The young bird acquires its musical repertoire by listening to melodies poured forth by a gifted master Usually the teachers are older canaries called campaninis Various musical instruments are also used in the training

The development of color and form have been the object of many breeders in Belgium England and Scotland One of the most graceful breeds is the Yorkshire canary with its long slim body Quite different is the plump Norwick canary some varieties of which are crested The lizard canary is noted for its beautifully mottled feathers The Scotch fancy is an odd

crescent-shaped creature, while the Belgian is a great hump-backed bird with massive shoulders. Scientific name of canary, *Serinus canarius*. (For care and feeding of canaries, *see* Pets.)

CANARY ISLANDS. The first glimpse of the Canaries (Spanish, *Islas Canarias*) is frequently the single snow-covered peak, 12,000 feet high, which dominates the island of Tenerife. In clear weather it can be seen at sea for many miles. It is a partially extinct volcano, and the natives thought it was the dwelling place of the evil one. Drawing nearer to the islands, the boat makes its first landing at Santa Cruz, also in Tenerife, which is the Spanish capital. The white flat-roofed houses make a dazzling picture under the tropic sun, and presently we see that the trees and shrubs are those of hot climates—date palms, orange trees, bananas, and cactus. The swarthy loafers along the quay and the handsome black-eyed girls suggest southern Spain, for the Spaniards have intermarried with the original native population to such an extent that it is impossible to distinguish any of the descendants of the ancient Guanchos.

Today the Canary Islands remain as one of the few possessions of the once mighty empire of Spain. Modern commerce has made them prosperous, but they still have a dreamy Old-World charm, and everywhere there are ancient monuments and castles that recall the fierce conflicts with the Guanchos, and the time when richly laden galleons used to stop at the islands on their way from the New World to Spain. And everywhere is the same contrast, so frequent in Spanish-speaking countries, typified in the narrow streets used both by ox-carts and electric street-cars.

The Canaries comprise seven principal islands—Tenerife, Grand Canary, Palma, Hierro, Gomera, Lanzarote, and Fuerteventura—besides smaller uninhabited ones. It is thought they may be the "Fortunate Isles" or "Isles of the Blest" which were often referred to in Greek and Roman legends, and their existence was probably known to the Phoenicians and Carthaginians. They were not rediscovered, however, till the 14th and 15th centuries, being located definitely by Gadifer de la Salle and Jean de Béthencourt in July, 1402. The chief products today are potatoes, onions, cochineal, tobacco, wine, sugar, and fruits. The islands are volcanic in origin and lie about 60 miles from the northwest coast of Africa. The total area of the islands—2,894 square miles—is a little more than that of the state of Delaware; the population (1950 census, preliminary), 776,912, is more than twice as great.

CAN'BERRA, AUSTRALIA. Like the city of Washington, this capital of the Commonwealth of Australia is an artificial creation. The constitution of the Commonwealth of Australia, adopted in 1900, provided for a new capital which should be separate from the capital of any state. After nearly ten years a site in New South Wales, in southeastern Australia, was chosen as the territory within which the new city was to be erected. It includes 912 square miles, and in addition 28 square miles on Jervis Bay for a port and naval college. The capital was formally inaugurated in May 1927, when Parliament met there for the first time.

The plan accepted for the new city, in 1912, was based upon designs submitted by Walter Burley Griffin, a Chicago architect, in a competition open to all the world. It presents a pleasing picture of hills crowned with beautiful buildings, and lowlands bordering a great artificial lake made by damming the sluggish waters of Molonglo River. Along the shores of the lake, and stretching far back, is an area of parklands unequaled in any other city of the world. On the summit of the ridge overlooking the valley stands the capitol building, and on a minor spur, just below, the houses of parliament. The chief residential quarter lies on the southern hills behind the capitol, well back from the valley. To the right and in front of the capitol are public offices; to the left, official residences. Across the valley are university buildings and hospitals on the lower ground, with a residential suburb on the higher ground to the north.

Canberra and its environs and Jervis Bay form the Australian Capital Territory. Population of Canberra (1947 census), 15,156; of whole territory, 16,905.

CANDY. When the children who lived a century or so ago saw a sweetmeat that looked like our candy, the first thing they thought of was—what do you suppose? Medicine! Because in the old days, what

PUTTING THE SYRUP ON TO BOIL

To make the syrup used for hard candies, sugar and water are cooked at a temperature of 340 degrees and then pumped into vacuum machines.

we call candy was made only by druggists and was used almost entirely to coat little pills and disguise the bitter taste, just as we today coat pills of quinine and other bitter medicines with chocolate.

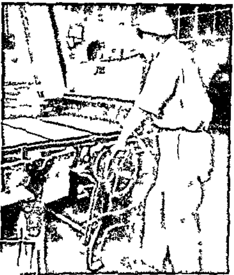
The druggists of those times also used to make candy drops containing peppermint, hoarhound, wintergreen, and other medicinal substances like those still sold in drugstores today. But all these candies

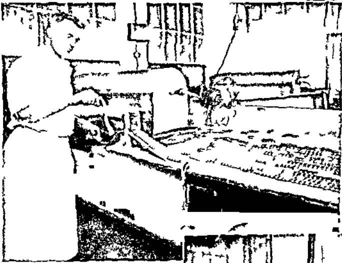
were considered as medicines rather than as pleasant things to eat The child of that time had only honey jams cakes and similar foods to satisfy his sweet tooth The nearest thing he had to our candy was sugar candy which was made at home by dissolving sugar in water and letting it crystallize

A little more than a hundred years ago enterprising men conceived the idea of making and selling candies for their own sake instead of as medicines and the candy industry was born At first everything was on a small scale Old fashioned stick candy molasses taffy and sugar plums—which are not plums at all but little plum shaped bonbons—were the principal products and the makers retailed their own can

HOW THINGS WORK IN A CANDY FACTORY

Those flat trays shown in the top picture are filled with corn starch powder which has been printed with hollowed out patterns by the machine The same machine then fills these molds with candy cream which hardens into the shapes that are so familiar to us In the next picture the workman is feeding a ribbon of soft candy into a geared machine which cuts it into those pillow shaped pieces we know so well The electric fan is cooling and drying them That big metal case in the bottom picture is full of almonds and candy paste As the case revolves the almonds become coated over with smooth layers of candy



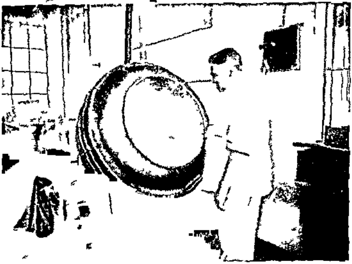


dies Later with the invention of ingenious machinery the industry grew rapidly especially in the United States which is the greatest candy-eating and candy making nation in the world

If you ever get a chance to go through a large candy factory you will be delighted to see what a sunny airy shining clean place it is with all the workers wearing *spotless aprons and caps* Nearly everything is done by machines One of the most complicated of these passes a tray under a cascade of finely powdered corn-starch levels the starch off makes impressions or molds in the starch fills the molds with cream and passes the filled tray on to the drying room At the same time it takes a pile of starch trays from the drying room picks out the bottom tray and turns it upside down on a screen where the starch is shaken off the hardened candy

Hard and Soft Candies

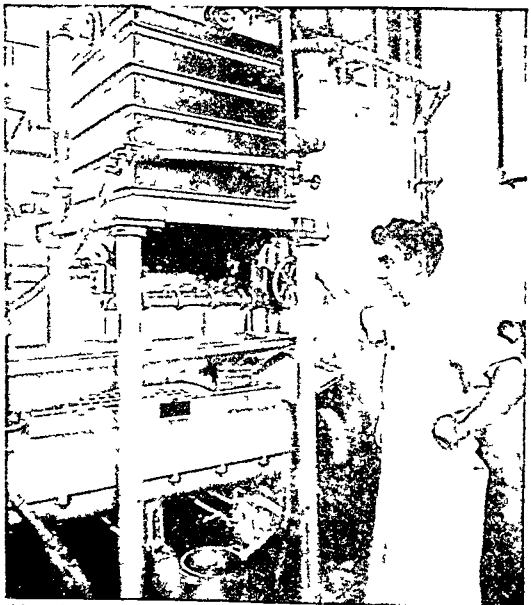
There are two principal classes of candy hard and soft Most of the hard candies are made by boiling sugar water glucose and flavoring and dumping the syrup on a marble or steel slab to cool The nearly hard candy is then rolled and cut into



balls, sticks, slabs, or squares. In making taffy the mass when it has become stiff enough is kneaded and pulled either by one of those pulling machines you have seen in the windows of large candy stores or by workers equipped with hooks. The pulling makes the mass white and porous.

Brittle candies like the familiar peanut brittle are made by merely melting sugar and glucose over a slow fire, adding nuts or other desired ingredients, and allowing the mass to cool.

MAKING SOFT CANDIES



After the syrup has been cooked at a temperature of 240 degrees, it is water cooled in this machine, and then cast in the proper shapes.

Soft or cream candies have *fondant* as their base, which is prepared by cooking sugar, glucose, and water to syrup, and kneading the syrup after it has cooled with long paddles until it becomes creamy and smooth. After being molded by the machine described above, the soft centers go to a coating machine, which supplies a coating of chocolate or other material.

How Candies Get Chocolate Coating

This machine, called an "enrober," has a moving belt which carries the centers into the machine. Here they encounter a short belt or wire mesh, through which soft chocolate is being forced from underneath, to coat the bottom of each piece. They then move on automatically to a third belt and are passed under a short section of wire netting above which is suspended a tank of chocolate coating kept warm by a steam-jacket. From the bottom of this tank a thin sheet of the chocolate flows continuously, coating the tops and sides of the creams. The surplus coating flows through the wire mesh into a pan beneath, from which it is automatically pumped again into the suspended tank. The finished chocolates then pass on to another belt, to which are attached at intervals sheets of heavily waxed paper. As each of these is filled it is removed by an attendant and carried on a truck to a cool room to dry. Very fine grades of chocolates are still coated by hand. The process of stamping the manufacturer's name on the bottom of the pieces is accomplished by placing them while warm and soft on tins or heavy papers on which the name is embossed.

Keeping Candy Pure and Wholesome

Federal and state laws safeguard the purity and wholesomeness of candy manufactured for sale. Under the Federal Pure Food Act the use of arsenic and other harmful mineral colors is not allowed. If coal-tar colors are used, manufacturers are restricted to a few certified colors guaranteed to be harmless. Adulteration is prohibited, in general, though certain substitutes such as cereals may be used if they are specified on the label.

American candy makers have developed an almost endless variety of forms. The simplest kind is the gumdrop, made from finely ground sugar mixed with gum arabic, or from sugar, corn syrup, and either cooking starch or gelatin, molded into the desired shape and sprinkled with sugar. Marshmallows are made from sugar, corn syrup, and either egg albumen or gelatin. Caramels consist of sugar, corn syrup, and flavoring, cooked with cream. Cane molasses is used in making molasses taffy.

Fruits, nuts, and flowers are candied by dipping them into a syrup which has been boiled until it is just at the point of crystallizing into sugar. Rock-candy is prepared by allowing a cooked sugar syrup to crystallize around strings stretched through the liquid. Various confectionery products are also imported from Eastern countries, the best known of which is the delectable "Turkish delight." This is a sticky confection made of gum arabic and gelatin, flavored with orange, cinnamon, attar of roses, or the like.

CANKERWORM. This caterpillar travels by a looping movement of its body and is often called a measuring worm, inch worm, or looper. It kills many fruit and shade trees by eating their spring leaves.

Green, gray, brown, or black, and not quite an inch long, it is the larva of a brownish-gray moth. The male moth is an inch across the wings. The female is wingless. She must crawl up tree trunks to lay her eggs near leaf buds. The larvae hatch in April or May, eat leaves 30 or 40 days, then spin threads of silk to let themselves down to the ground. In the soil they turn into brown pupae, from which one species emerges as a moth in the fall, another species in the spring. Otherwise the two species are very much alike in appearance and habits.

Many birds eat cankerworms. Indeed, it was to fight them that the United States first imported English sparrows from England in 1850. Many trees are saved by spraying the leaves early in spring or by placing sticky bands around the trunks early in October.

CANNA. The canna plant, a native of warm lands throughout the world, was once noted only for its large leaves and for its reed-like stem that sometimes grew as high as 14 feet. Its small red flowers became ragged in a day, and it was planted solely for foliage.

The French gardeners turned to seed selection and cross-breeding. In 1863 they produced a bril-

A POPULAR BORDER FOR A GARDEN

The stately canna grows best in a warm moist soil. Cannas are often planted around the edge of a garden where their large leaves and brilliant blossoms make a colorful border

liant variety of canna which flaunted large scarlet and gold blooms above great leaves of green and bronze. Italian specialists later cultivated dwarf varieties about four feet high which became popular in the United States. The flowers of some cultivated cannas measure six inches across. In color they may be red, yellow, pink, lemon, salmon or rose. Some blossoms are shaped like orchids.

The name canna means "reed" in Latin. The wild plant was called "Indian shot" by American boys because its hard seeds served them as buckshot.

Cannas may be propagated either from seed or by dividing the rootstock and planting in pots. The plants are injured by frost and should not be set out too early. Rich warm soil with plenty of moisture is desirable. Pick the flowers as soon as they wilt to prevent the formation of seeds and the flowers will keep coming all summer. After the stalks have been cut in the fall the roots may be stored and handled like potatoes. The canna belongs to the family *cannaceae*. Scientific name of the canna, *canna generalis*.

CANNING Foodstuffs may be preserved for years if they are properly heated and then hermetically sealed in tin lined metal cans, glass jars or other containers. The word "canning" came from the use of cans as food containers. (For information on canning and other preserving processes *see* Food Preservation.)

CANNON Originally cannon meant a tube or smooth cylindrical bore; then the term was applied to heavy guns carried on and fired from mounts or carriages. The introduction of rifling made smooth bore cannon obsolete. (*See* Artillery; Firearms; Machine Gun.)

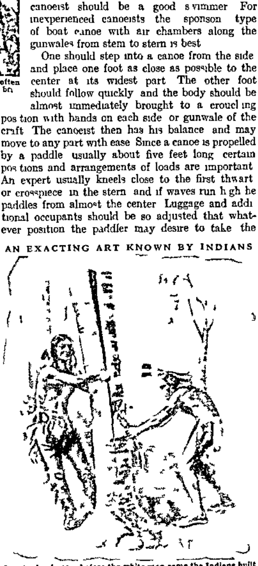
CANOES AND CANOEING The canvas-covered or all wood canoes of today still closely resemble the swift-moving craft that North American Indians made principally by stretching bark or skins over light but strong cedar frames. Like their forerunners they are keelless and pointed at each end. The most popular type is about 18 feet long, 30 to 34 inches wide and weighs around 60 pounds. Aluminum canoes are considerably lighter.

Its light construction makes a canoe ideal for shallow or turbulent streams. It will float in only a few inches of water and can easily be carried over unnavigable stretches or from one body of water to another. This method of transfer is called a *portage*.

On larger inland waters and along sheltered seacoasts sailing canoes are commonly used, sometimes with leeboards, which serve as a keel. Since a canoe is so light and has no keel it may easily be overturned, so every canoeist should be a good swimmer. For inexperienced canoeists the sponson type of boat, a canoe with air chambers along the gunwales from stem to stern, is best.

One should step into a canoe from the side and place one foot as close as possible to the center at its widest part. The other foot should follow quickly and the body should be almost immediately brought to a crouching position with hands on each side, or gunwale, of the craft. The canoeist then has his balance and may move to any part with ease. Since a canoe is propelled by a paddle, usually about five feet long, certain positions and arrangements of loads are important. An expert usually kneels close to the first thwart or crosspiece in the stern and if waves run high he paddles from almost the center. Luggage and additional occupants should be so adjusted that whatever position the paddler may desire to take the

AN EXACTING ART KNOWN BY INDIANS

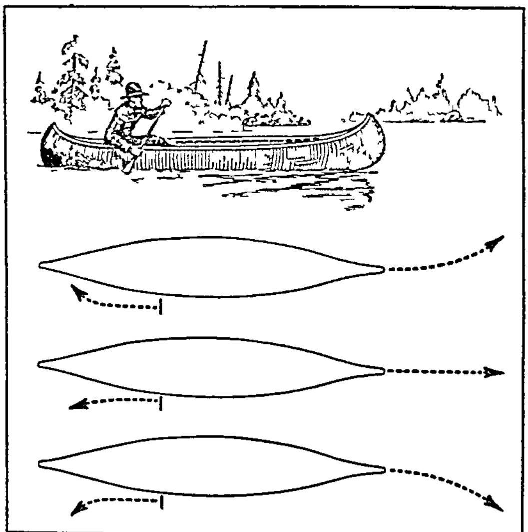


Hundreds of years before the white man came the Indians built sturdy birch bark canoes. These Indians carefully strip the bark from a birch tree to cover the framework of their boat

craft will rest evenly on the water for practically its entire length. In fair weather a canoe may be paddled from either side, but in a breeze it should be propelled from the side away from the wind, which will tend to throw the bow off its course.

Most primitive peoples use the "dugout" canoe, made from a log shaped roughly on the outside with axes, while the interior is burned out. The canoe is the common craft among the natives of the South Pacific islands. Canoes 100 feet in length are not uncommon. Sometimes two are joined by poles and carry 50 or more passengers.

HOW A PADDLE PROPELS AND STEERS



An expert canoeist can make his craft dart ahead, back, or turn; all with dexterous twists of the paddle, as the diagrams explain. A stroke straight back, followed by drawing the paddle inward, turns the bow to the left. A slight outward turn at the end of the stroke keeps the bow going straight ahead, while a stronger outward turn steers the bow to the right.

The birch-bark canoe of the North American Indians has never been surpassed. Although light enough to be carried by one man, it is so buoyant that it can bear a heavy load. A light but strong wood framework is covered with sheets of birch-bark sewed with fibers, and the seams are closed by heavy resinous gums. The Indians also built large canoes to carry many warriors. Today "war canoes" manned by a dozen or more paddlers are used in boys' camps.

The *kayak* of the Eskimo, usually constructed for a single occupant, is used for fishing and sealing trips. A light framework of bone or wood is covered with skins and decked over except at the center. There a circular space, or cockpit, is left for the occupant, who laces himself in tightly with a skin apron, which prevents waters from entering. Eskimos also use a large undecked boat constructed of skins, called the *oomiak* (sometimes called *umiak*), or "woman's boat," to carry many persons or large loads.

In 1865 John MacGregor, a Scotsman, invented the wooden "Rob Roy" canoe, built like the Eskimo kayak. A Rob Roy is almost entirely decked over, with a cockpit large enough for only one occupant, who uses a long paddle with a blade at each end.

Canoe racing has been directed by the American Canoe Association since 1880. Regattas each year attract experts both in paddling and sailing. The latter sport is winning favor. Canoes with sliding seats, outrigger keels, and one or two sails, make remarkable speed. In 1909, the sail spread was limited to 90 feet

CANTALOUPE. This variety of muskmelon is named for Cantalupo, Italy, where it was first grown. The name is now given to the American melon (*see* Melons).

CAN'TERBURY, ENGLAND. On a spring morning more than 1,300 years ago, when the fair land of Britain had relapsed into heathenism after its conquest by the Angles and Saxons, King Ethelbert of Kent, looking out from his city of Canterbury, saw approaching a procession of Christian monks. They bore before them a silver cross that gleamed in the sunlight and a picture of Christ painted on wood The holy father Augustine was their leader and they had been sent from Rome by Pope Gregory the Great to carry the message of Christ to the English

When a young man, so runs the beautiful story, this good pope had seen English boys as slaves in the Roman market. Their blue eyes and golden hair attracted his attention, and he inquired: "Whence come these fair youths?" "From the country of the Angles," he was told. "Truly, they should be called Angels, and not Angles," he replied, "for they have angelic faces." From that day he determined to convert "Angleland," or England as we now call it, to the Christian faith; and now this little band had come to carry out this purpose in the year 597 A.D

Ethelbert's wife, a Frankish princess, was already a Christian, so the king welcomed the monks. Before long he was won over to the new faith and baptized His example was followed by 10,000 of his subjects Augustine was soon made an archbishop by the pope, and from that time on Canterbury has been the center of English Christianity and the Archbishop of Canterbury has been "primate" of the Church of England

Beginning of the Great Cathedral

About 500 years after the death of St. Augustine, the ancient Roman church in which he had preached was destroyed by fire. The building of a new cathedral or archbishop's church was begun by Norman architects and builders in the reign of William the Conqueror; but most of the present structure is later. It took four centuries to build, and the story of its growth into its present majestic form is the story of how faith triumphs over misfortune—for it was many times pillaged and damaged by fire, but each time rebuilt, enlarged, and made more beautiful.

Canterbury cathedral still towers proudly over the old-fashioned town "like a hen brooding over her chickens." Busy little shops nestle close to the stone gateway with its quaint ancient sculptures; but when we pass through this into the wide precincts or "close" of the cathedral, the noise of trade and traffic is shut

out, and the peace and quiet of the cloister hold sway In this "church city" are the palace of the archbishop and the houses of the other clergy who serve in the cathedral—the dean and the canons Here, too, is the old monastic cloister begun in the 11th century The chapter-house or sermon house as it is now called, and the library have been restored and are now in use All about these gray stone buildings is velvety lawn green as only English turf is green, and in the midst towers the giant cathedral—rugged time-worn, weather beaten, yet gloriously beautiful still Flanking the western front are two fine towers, but the eye is carried irresistibly to the center of the structure where high above all rises the cathedral s most striking feature—the Angel Tower or ' Bell Harry ' with its beautiful proportions and delicate carvings its lancet windows and soaring pinnacles

CANTERBURY CATHEDRAL, GLORIOUS MONUMENT OF FAITH

Here is the noble mother church of England which in its beautiful walls and Gothic towers tells in stone of the faith and courage of its builders and the religious history of England for nearly a thousand *years It was built chiefly in the 14th and 15th centuries* and is in the perpendicular style of Gothic

Entering the cathedral we visit the Chapel of the Martyrdom and see the spot where *Thomas Becket* was slain in the 12th century (*see* Becket, Thomas) For three centuries after, Becket was looked upon as a martyr and a saint, and a constant stream of pilgrims flowed to Canterbury to visit his shrine This enormously rich shrine is no *longer there,* but deep grooves in the stone steps show where countless worshipers ascended to it on their knees

Chaucer in his 'Canterbury Tales' pictures such a band of pilgrims as might have been seen in his day, bent on pleasure as well as religious duty, leisurely enjoying their journey and telling stories along the road (*see* Chaucer, Geoffrey) We can still visit the old inn, known as Chaucer's Inn, where such a company may have been housed, and can also see the old city gate, part of a wall that surrounded the town in those medieval days, through which they may have passed

New life however, has entered the old city Along the hurrying River Stour are mills, tanneries, and breweries, and a thriving trade is carried on in grain and hops But the new has not driven out the old. The medieval houses with their overhanging gables, the 15th-century Guildhall and St Martin s Church, dating from Roman days and said to be the oldest church in England all point to bygone days Population (1951 census preliminary), 27,778

There was a town on the site when Julius Caesar invaded Britain in 55 B C The Romans named it *Durovernum* Later it was the center of the early English kingdom of Kent It was called *Cantwaraburh* (Kentishmen's town) In time, this became ' Canterbury "

FLOATING VILLAGES CROWD CANTON'S WATERWAYS

This narrow channel separates Canton, on the right, from Shameen, on the left. Shameen was a prosperous foreign settlement until the Communists came to power in China. The channel is crowded with houseboats, called *sampans*. Thousands of poor Cantonese spend their lives in such floating houses.

CANTON, CHINA. Canton is the largest city in southern China. It is the capital of the province of Kwangtung, and the name Canton is a careless English way of saying Kwangtung. The Cantonese call their city Kwangchow.

The city stands at the head of a wide, fertile delta. This delta was formed by many mouths of the great river of southern China, the Si Kiang. Canton lies on the main channel, called the Canton, or Pearl, River. Its harbor is too shallow for large ocean-going vessels; but the river connects it with the great island port of Hong Kong, 80 miles to the south. Railways link it with Kowloon, on the mainland opposite Hong Kong, and with central China. The Si Kiang serves as a highway across southern China.

The Canton Delta is one of the most crowded areas in the world, with more than 3,000 persons for every square mile. The climate is tropical, and deposits of river mud have produced rich soil. It yields two crops of rice a year as well as fruits and vegetables. Land is so precious that thousands of families live in flat-bottomed houseboats—called *sampans*—on the many delta streams. Poverty has caused millions of Cantonese to emigrate. In the United States, Hawaii, the Philippines, Indo-China, and Malaya most of the Chinese are Cantonese.

The Cantonese have a saying, "Everything new originates in Canton." Many Cantonese returned to their birthplace after saving modest fortunes elsewhere and brought back ideas strange to conservative China. Cantonese who had lived in America helped to reorganize the government. The city walls were torn down to make way for wide boulevards. Tall buildings rose on the water front, and busses and trolleys connected the city with suburbs. The older sections, however, still have streets about eight feet wide, lined with low hovels and two-story shops, but gay with bright-painted signs. In these narrow streets people get about on foot or ride in sedan chairs carried by coolies. Coolies also transport goods in wheelbarrows or carry bundles on bamboo poles slung across their shoulders.

Arabs and Persians traded in Canton in the 4th century. In the 16th century the Portuguese came and later the Dutch. In 1757 the Chinese made Canton the sole port for foreign trade. Clipper ships from New York, Boston, and old Salem sailed to Canton by way of Cape Horn and brought back silk, ivory and jade carvings, mother-of-pearl work, fans, brassware, porcelain, and embroideries. Following the Opium War (1839–42) between Great Britain and China, Canton was made a treaty port open to foreigners. This war gave Britain possession of Hong Kong. With the rise of this great ocean port, Canton became the distributing point for southern China.

In the 1920's Canton was the center of the revolutionary movement led by Sun Yat-sen. The Japanese occupied the city 1938–45. For six months in 1949 it was the capital of Chiang Kai-shek's Nationalist government. On October 15 the Communists took the city without opposition, and the Nationalist government fled to Formosa. The Communist government seized basic industries and took over control of both foreign and domestic trade. Most of the foreign merchants and industrialists left the city. Those who remained were severely handicapped by government discrimination. Population (1947 est.), 1,413,460.

CANTON, OHIO. A fertile farming plain and near-by coal mines, limestone quarries, and deposits of ceramic clays have helped build Canton into a trade and industrial center of eastern Ohio. After the lake port of Cleveland, 55 miles northwest, made Lake Superior

iron ore available to Ohio mills Canton developed many industries based upon steel Today the city s leading manufactures are steel alloys roller bearings safes and bank vaults structural steel vacuum cleaners cement soap and water softeners and gasoline and Diesel engines

Canton was founded in 1805 and became the seat of Stark County four years later Its first industry was a gristmill, soon after a plow factory was started The first rail line reached the town in the 1850 s and in 1854 Canton was chartered as a city

William McKinley the 25th president of the United States lived in Canton and conducted his 1896 campaign for election from the city The McKinley tomb and an art museum that houses many McKinley mementos are historical attractions Canton has a vocational high school and the William McKinley School of Law The Stark County Fair is held in September Canton s slow but sound growth has made it Ohio s eighth largest city It is governed by a mayor and council Population (1950 census) 116 912

CANUTE (*kă-nut*) (995? 1035) King Canute called the Great was the first Danish king of England For a century before his reign the Danes or Northmen had been raiding the country (*see* Northmen) In 1013 Canute sailed to England with his father Sweyn king of Denmark and shared in his victorious campaigns Sweyn died in 1014 and Canute continued the struggle Edmund Ironside the Saxon king put up such strong resistance that Canute agreed in 1016 to divide the kingdom with him Edmund died a few weeks after this treaty was made and the young Danish conqueror became king of all England

Canute at once put to death his most powerful enemies The rest of his long reign 1016–35 was peaceful and orderly The death of his elder brother gave him the throne of Denmark Later he gained the crown of Norway as well When he died in 1035 his empire fell apart His son Harold ruled England until 1040 and another son Hardecanute until 1042 Then the Danish line ended with the crowning of a Saxon king Edward the Confessor

A well known story tells how Canute rebuked his flattering courtiers He had his throne placed on the seashore and when the tide came in he ordered the sea to fall back When the water reached his feet he turned to his courtiers and said Let all men know how empty and worthless is the power of kings for there is none worthy of the name but Him whom heaven earth and sea obey "

CANYON In the western part of the United States many rivers have cut deep channels with steep sides Such a gorge is called a canyon from the Spanish word *cañón* meaning tube Canyons usually occur in the upper courses of rivers where the current is swift and in dry regions where there is not enough rainfall to widen the channel into a broad valley with sloping sides Some of the most notable examples are the canyons of the Rio Grande Yellowstone and Colorado rivers (*See also* Grand Canyon)

CAPE BRETON ISLAND CANADA A French explorer of the 17th century described Cape Breton Island as a very beautiful land on the coast of Acadia The traveler still delights in its wild mountains with breath taking views across the sea its forests and lakes and its valleys He also finds descendants of Scottish and French settlers keeping the language and customs of their ancestors

The island is a part of the province of Nova Scotia, but it is separated from the main body by the narrow Strait of Canso on the south Across Cabot Strait to the north is Newfoundland The Atlantic Ocean lies on the east and the Gulf of St Lawrence on the west Its land area is 3 120 square miles The greatest length is 110 miles the greatest width 87 miles

The ancient granite hills of Cape Breton are a part of the Appalachian Mountain system They are from 1 000 to 1 500 feet high The wildest most rugged area at the north end of the island is preserved in the Cape Breton Highlands National Park (390 square miles) The 185-mile Cabot Trail most spectacular highway

VIEWING SEA AND MOUNTAIN FROM THE CABOT TRAIL

The motor highway known as the Cabot Trail winds over forested mountains in Cape Breton Highlands National Park Breath taking views of the Gulf of St Lawrence open out, as in this scene At many points the highway clings to the cliffs directly over the sea

in eastern Canada, rims the park. The interior of the park is a wilderness of forest, lake, and high plateaus covered with muskeg and reindeer moss.

Another striking feature is the Bras d'Or (Arm of Gold) lakes. This is an almost landlocked arm of the Atlantic which extends through the heart of the island. With nearly a thousand miles of interior coast line, it forms one of the finest yachting courses in the world.

The deep-sea and in-shore fisheries are an important industry. The lovely Margaree Valley is the chief farming area. Cape Breton's coal deposits are the largest in eastern Canada. The field near Sydney extends far out under the Atlantic and is being worked more than three miles from shore. Sydney, the largest city (population, 1951 census, 31,317), is a steel-manufacturing center. Iron and limestone are shipped into its fine harbor from Newfoundland.

Cape Breton Island was perhaps the first land sighted by John Cabot (1497) on the coast of North America. No permanent settlement was made until the building of the Fortress of Louisbourg after the Treaty of Utrecht (1713). This base of French power in the New World was destroyed by the English in 1760. Its ruins are a national historic park.

Acadian and other French settlers and United Empire Loyalists arrived at the end of the 18th century. Early in the 19th century there was a large influx of Scottish Highlanders. More Gaelic is spoken on the island than in Scotland itself. At St. Ann is the only Gaelic college in America. The annual Gaelic Mod and Highland Gathering is a four-day festival of dancing, singing, and sports.

In 1902, a wireless station built at Glace Bay sent a message across the Atlantic to King Edward VII. The island is divided into four counties—Cape Breton, Inverness, Richmond, and Victoria. (*See also* Nova Scotia.) Population (1951 census), 157,696.

CAPE COD. This portion of Massachusetts is an L-shaped peninsula reaching out into the Atlantic Ocean. (For air view, *see* Massachusetts.) It is about 65 miles long from Nantucket Sound north to Cape Cod Bay and is from one to twenty miles wide. It is low and sandy, with numerous cranberry bogs. At the head of the Cape are pine and oak woods. On many of the harbors are picturesque fishing villages. Some of them have become art colonies. Provincetown, Hyannis, Chatham, and Barnstable are favorite summer resorts. In the rural districts people earn their living by raising cranberries, strawberries, and poultry.

The Cape Cod Canal was opened across the neck of the peninsula for 7.6 miles in 1914. It joins Cape Cod Bay with Buzzards Bay, saves about 70 miles in the voyage between Boston and New York, and permits vessels to avoid the shoals of Nantucket. The United States government purchased it in 1928 for $11\frac{1}{2}$ million dollars as a link in the Intracoastal Waterway. In 1935 construction began on enlarging the canal to a depth of 32 feet and a width of 540 feet. Including its channel approaches, the canal is 17.4 miles long. Two highway bridges and a railroad lift bridge span the canal.

Cape Cod was discovered May 14, 1602, by an English navigator, Bartholomew Gosnold. Supposedly he gave it its name from the quantity of codfish taken off its shores. On Nov. 19, 1620, the *Mayflower* sighted its coast and two days later cast anchor in what is now the harbor of Provincetown.

CAPE OF GOOD HOPE. The largest province of the Union of South Africa is Cape of Good Hope, or Cape Province. Discovered by Bartholomew Diaz in 1488 (*see* Diaz), the Cape was first settled in 1652 by Dutch colonists led by Jan van Riebeeck. After the British gained control it remained a British colony until 1910, when the Union was formed (*see* South Africa, Union of).

The Cape Province lies in the southern tip of Africa between the Atlantic and Indian oceans. It has a regular coast line with many bays. Table Bay and False Bay are separated by the Cape peninsula which terminates in the Cape of Good Hope. Cape Agulhas, on the Indian Ocean, is the southernmost point of Africa. Most of the province lies on the great plateau called the high *veld*. The chief mountain range is the Drakensberg, which extends into Natal. The climate is generally dry and temperate. Agriculture and mining are the chief industries (for exports, *see* Capetown). Port Elizabeth and East London on the southeast coast are manufacturing centers. The great port of Capetown is both the provincial capital and the legislative capital of the Union. The province is governed by an administrator appointed by the Union's governor general. Area, 277,113 square miles; population (1951 census, preliminary), 4,420,657.

CAPETOWN, UNION OF SOUTH AFRICA. Capetown is both the capital of Cape of Good Hope Province and the legislative capital of the Union of South Africa. One of the most beautifully situated cities in the world, it lies along the shore of Table Bay at the foot of Table Mountain, about 30 miles north of the Cape of Good Hope (for picture, *see* Africa).

Entering the city from the sea, one passes from the Duncan Dock area, along King's Way, into Capetown's main thoroughfare, Adderley Street. At the top of this street are the Union House of Assembly, Government House, St. George's Cathedral, and the Dutch Reformed Church. Behind the government buildings the Botanical Gardens rise toward the slopes of Table Mountain. Here are the National Art Gallery and the South African Museum of Natural History. Across the Grand Parade from City Hall is the oldest building in South Africa—the Castle—a fort built in the 17th century. In suburban Rondebosch are the prime minister's residence (Groote Schuur) and the University of Capetown.

Capetown is one of the greatest ports in the Southern Hemisphere. The principal exports are diamonds, gold, wool, hides, dried and canned fruit, wine and brandy, and rock lobster. Chief imports are automobile parts and machinery. There are many small manufacturing industries, including food products, shoes, textiles and clothing, tobacco, drugs and cosmetics, furniture, chemicals, and leather goods.

SIGNAL HILL OVERLOOKS CAPETOWN

The white buildings of Capetown gleam in the sun. A long breakwater protects the city docks from the open waters of Table Bay.

The city was founded by the Dutch in 1652. The British gained control after the Napoleonic wars. Capetown became the legislative capital when the Union was formed in 1910. In the second World War it was an important base for allied naval operations.

The climate is like that of southern California. Rainfall is heaviest from June to August, the winter months. The population—white Europeans, Cape Coloreds and Negro Africans—is 512,822 (1951 census preliminary). (*See also* South Africa, Union of.)

CAPE VERDE (*vurd*) **ISLANDS**. An overseas province of Portugal, these islands lie in the Atlantic Ocean off the west coast of Africa, north of the equator. They are about 320 miles from Cape Verde, for which they were named. There are ten main islands and several rocky islets. The total area is 1,557 square miles. The islands are of volcanic origin, but the only volcano active today is on Fogo. The climate is hot and very dry. Rainfall averages from 5 to 11 inches a year. Farming is confined to small areas. The principal products are coffee, castor beans, tobacco, oranges, sugar cane and hides.

Other than a few thousand white Europeans, the people of the islands are either Negroes or of mixed blood (mulattoes). Praia, the capital, is on São Tiago (Santiago), the largest and most populous island. Porto Grande on São Vicente (St. Vincent) is a coaling station on the route from Europe to South America. Most of the people speak Portuguese and Portuguese money is used.

The Cape Verde Islands were discovered in 1456 by an Italian navigator in the service of Prince Henry of Portugal. Since then the islands have been in the possession of Portugal except for the brief period when Spain ruled the mother country. Total population (1950 census preliminary) 147,328.

CAPILLARY ACTION. If you drop the corner of a towel in a bathtub of water, the water climbs up the threads and soon the whole towel is wet. If you dip one end of a lump of sugar in cocoa, in a few seconds the whole lump is soaked. Blotting paper takes up ink and lampwicks raise oil in the same way.

Men first studied the action of this force in tiny tubes little larger than a hair, and so they called it *capillary attraction* or *capillarity*, from the Latin word *capillus*, meaning hair. They found that when one end of a very small tube is put in a glass of water, the water will rise in the tube a little above its level in the glass. The finer the tube, the greater the height to which the water will rise. This behavior is caused by the action of *surface tension*, as explained in the article Liquid. Sugar, salt, starch, sponges and the fibers of plants all have a multitude of tiny tubes and hollows that pull up water or other fluids just as the glass tube does.

Capillarity is very important in farming. Here it is the soil particles that pull the water up, just as a lampwick or a towel does; the smaller the particles of dirt and the closer they are together, the more freely the moisture rises. Sometimes after a summer shower the upper layer of earth is packed in a hard crust. Then the moisture absorbed by this tightly packed earth is quickly evaporated into the air and thus lost to the soil and the plant roots.

In regions where there is a great deal of rainfall in the early spring but very little through the hot summer months, farmers use *dry farming* methods. First, the soil is plowed deep and fine and packed down so the moisture can come up readily around the roots of the plant. On the surface the soil is stirred and worked to make a layer of dry pulverized earth called a *mulch*. This checks the moisture and keeps it from evaporating into the air.

CARBOLIC ACID. The chief use of carbolic acid is in the manufacture of plastics. Also called phenol, carbolic acid is a white crystalline poisonous solid. Phenolic plastics are made from carbolic acid and formaldehyde. These plastics are molded into such familiar products as telephone handsets and coffeepot handles. Bakelite, the earliest phenolic plastic, was first used commercially in 1909. (*See also* Coal Tar Products; Plastics.)

Phenol is used also in antiseptic and disinfecting solutions, in dyes, perfumes, soaps, tooth powders, photographic developers, and as a sensitizer of photographic plates. With nitric acid, phenol forms picric acid, used in explosives (*see* Explosives).

Natural phenol is obtained from coal tar, but nearly 90 per cent of commercial phenol is made synthetically from benzene (benzol), which is itself a coal tar product. By use of benzene, phenol can also be extracted from the ammonia liquors of by-product coke plants. Most synthetic phenol is made by heating chlorinated benzene with caustic soda solution under high pressure.

The crude product is a dark colored oil; when purified it forms large colorless crystals. Pure phenol has

a very corrosive action on the skin, producing white burns which are difficult to heal. A 3 per cent solution is used for washing wounds and disinfecting the hands, as that strength is sufficient to kill bacteria. Taken internally it is a strong poison.

CARBON. Diamonds, pencil leads, and soot—three very different substances—are all nearly pure carbon. Every living thing on earth contains carbon, and such substances as coal and petroleum, which were formed from living things, contain very high proportions of it. Anthracite, or "hard coal," is more than 90 per cent pure carbon.

Carbon is thus one of the most important chemical elements. It exists in three forms, or *allotropes*. The diamond is a crystal of closely packed carbon atoms and is the hardest substance known. Graphite, the black substance used in lead pencils, has crystals of a different form; it is extremely soft. Lampblack, or chemically pure soot, is the amorphous form of carbon; that is, it consists of atoms loosely packed in no particular arrangement.

All three forms of carbon have important industrial uses. Nonprecious industrial diamonds are a widely used abrasive and cutting agent. Flaky, slippery graphite is an excellent dry lubricant. Large quantities of graphite are also used in the manufacture of lead pencils, crucibles, and electrodes for dry cells and arc lamps. Lampblack (also called carbon black) is obtained by burning gas or other combustibles and collecting the soot. It is used as a black pigment in ink, paint, and other substances, and as a toughening agent in rubber manufacture. (*See also* Diamond; Graphite.)

The element carbon unites readily with many elements, forming more than a quarter of a million known compounds. The study of carbon compounds is called *organic* chemistry because it was long thought that such substances could be produced only by living plants and animals (*see* Chemistry, subhead "Organic Chemistry"). Compounds of carbon and hydrogen are known as *hydrocarbons*. The long series of hydrocarbons include the liquid and gaseous fuels and such useful products as natural rubber (*see* Hydrocarbons). Another large group of carbon compounds is known as the *carbohydrates*. In all carbohydrates, as in water (H_2O), one atom of oxygen is present for every two atoms of hydrogen. The carbohydrates include sugars, starches, and cellulose. With oxygen alone, carbon forms carbon dioxide (CO_2) or carbon monoxide (CO) (*see* Carbon Dioxide).

The chemist's symbol for carbon is C; its atomic number is 6 and its atomic weight is 12.010. The element is known to have several *isotopes* (*see* Atoms). Nearly 99 per cent of natural carbon is carbon 12, the common isotope, and about one per cent is carbon 13. A minute proportion of natural carbon is carbon 14, a radioactive isotope formed by the action of cosmic rays on nitrogen atoms in the air. Carbon 14 is used by archaeologists and geologists in determining the age of ancient plant and animal remains, (*see* Geology; for picture, *see* Archeology).

CARBON DIOXIDE AND MONOXIDE. Every animal that lives is constantly breathing forth carbon dioxide (often called "carbonic acid gas"), and every fire where carbon compounds are burned gives off this colorless, tasteless gas. Plants with green foliage, on the contrary, take up carbon dioxide from the air during the daytime, consume the carbon in it, and give back the oxygen to the air (*see* Leaves).

Carbon dioxide contains one atom of carbon to two atoms of oxygen, hence its chemical symbol is CO_2. It forms about $\frac{1}{2500}$ of the earth's atmosphere. Carbon dioxide is heavier than air, and can be carried in a vessel and poured like water. Unlike oxygen, it does not support combustion, but will put out a fire. Some chemical fire extinguishers, therefore, are constructed so as to give off carbon dioxide. If the pure gas is breathed, or air containing considerable quantities of it, it will cause death through suffocation, because the lungs do not get the necessary oxygen. Under the name of "choke damp" it is one of the perils most dreaded by the miner. Dissolved in water it forms carbonic acid. "Charged" water (soda or seltzer water) is made by charging water with carbon dioxide under pressure.

Under a pressure of 600 pounds to the square inch, the gas becomes liquid. If the liquid gas is sprayed through a small jet, it evaporates rapidly, and part of the liquid solidifies into white snow. This intensely cold snow (−110°F.), made from carbon dioxide obtained from burning coke or as a by-product, notably of fermentation, is pressed into cakes, called "Dry-Ice," or "carbice," and used for refrigerating.

Carbon monoxide is an even more dangerous gas. It differs from carbon dioxide in containing only one atom of oxygen to one of carbon; its chemical symbol therefore is CO. It is highly poisonous, and causes death when a person remains too long in a closed bathroom with a gas heater in operation, or in a closed garage with an automobile engine running. It is present in illuminating gas and it makes the gas dangerous to breathe even in small quantities. Carbon monoxide escaping from coal stoves or furnaces sometimes kills whole families.

CARDINAL. Against green trees or white snow, the scarlet cardinal makes a brilliant flash of color. The loud clear whistle, *what cheer, what cheer* or the rolling carol ending in *wheat, wheat, wheat,* are sung in summer and even on sunny winter days. The female cardinal sings, unlike most female birds.

The cardinal is about 8¼ inches long, a little smaller than a robin. It has a high crest, and thick red bill. The throat and area around the base of the bill are black. The female and young have gray-brown backs and dull red wings, tail, and crest.

The cardinals build their nest in a low bush. It is made of twigs, roots, and strips of bark and lined with grass. The two to four eggs are bluish-white spotted with brown. They hatch in 12 days. The male cares for the young after they leave the nest, while the female busies herself with the next family. He is a fussy and devoted father, hopping about in the

greatest excitement until the little birds are able to fly Cardinals eat weed seeds berries and a great variety of insects and larvae

They do not migrate but spend the winter in *their nesting areas Once considered southern birds they are slowly* extending their range northward They are now found from South Dakota to the Gulf *coast east of the Great Plains The Arizona and gray tailed cardinals* live in the Southwest The cardinal is the state bird of Illinois Indiana Kentucky North Carolina Ohio Virginia and West Virginia Its scientific name is *Richmondena cardinalis* (For pictures in color see Birds Egg)

Cardinals College of The importance in the Roman Catholic church of these advisers of the pope is shown by their very name Cardinals which means superior or excellent (*from the Latin cardo* a hinge) The pope usually seeks their advice on all important questions of church government Since the year 1059 they have formed a body known as the College of Cardinals At the death of a pope it has the important duty of choosing the new head of the church From time to time the pope presides at a formal meeting *of the cardinals called* a consistory The general affairs of the church are discussed and important announcements of policies may be made A greater part of the church administration also is conducted by commissions of cardinals called congregations (*see* Papacy) Though the cardinals rank next to the pope in importance in governing the church this office gives them no place in the ecclesiastical hierarchy of priest bishop etc

Originally the cardinals consisted of the chief priests of the churches in Rome together with a certain number of deacons and the bishops of the seven neighboring dioceses Even today they are distinguished as cardinal bishops, cardinal priests and cardinal deacons according to the offices which are assigned to them in the churches about Rome

Cardinals are appointed by the pope They hold office for life The maximum number of 70 cardinals fixed by Pope Sixtus V in 1586 has rarely been reached In 1946 however Pope Pius XII created 32 new cardinals filling the College for *the first time since* the 18th century To stress the universality of the church he chose them from 19 nations In 1953 he *again filled the College by vesting* 24 including one from the United States bringing its total to 4

THE BRILLIANT CARDINAL

This alert looking cardinal is standing on a tree stump draped with Spanish moss Perhaps it wants a strand of the moss to use in building its nest Notice its perky crest and heavy beak.

Italy's total was 27 From the official emblem of a cardinal a scarlet hat with 15 tassels on each side comes the name cardinal for a certain shade of red

A species of lobelia (*Lobelia cardinalis*) is called the cardinal flower because of its showy scarlet blossoms (for illustration in color *see* Flowers)

The Romans gave the name *cardinal virtue* to *justice prudence temperance and fortitude because* all other virtues hinge (*cardo*) on those four *Cardinal numbers* 1 2 3 and so on tell *how many* On them hinge *ordinal numbers*—first second third and so on—telling order' (*see* Number System)

Cards Playing Cards for playing games of chance are of the most remote antiquity and are used in almost every country The games played are as various as the size of the packs and the designs on the pasteboards

Playing cards were introduced into Europe about the middle of the 14th century Probably they were brought from Asia either by returning crusaders or through commerce with the Saracens and Moors of northern Africa An early Italian chronicler lends support to the latter view for in an old document he says In the year 1379 the game of cards was introduced into Viterbo (in central Italy) coming from the land of the Saracens where it is called *naib*

At first cards were painted by hand and were very expensive The accounts of the French king Charles VI for the year 1392 show the payment to a painter of a sum equal to $500 for three packs of cards *in gold and various colors ornamented with different designs* Between 1420 and 1430 even before the invention of printing from movable type the new art of block printing (engraving) was used to make playing cards This process reduced the price and spread the use of cards The city of Ulm in Germany became one of the chief centers of the manufacture

It would be a dizzy chase to follow in detail the evolution of the pictured royalties on the cards and their shining trains One theory holds that on the early Italian cards the four suits represented the four classes of society—nobles peasants clergy and citizens The early German cards however mark *the suits respectively* with hearts bells leaves and acorns Our familiar hearts clubs spades and diamonds come to us from the French

The face or court cards of the early packs were the king knight and valet (jack or 'knave

at times known as the court fool). The Italians substituted a queen for the knight, and this is now the usual custom. Today 52 cards usually make up the pack in America, with extra cards called "jokers" being added for use in certain games.

CARIBBEAN SEA. One of the great crossroads of the world for ocean shipping is the Caribbean Sea. Ships of many nations cross it as they approach or leave the Atlantic end of the Panama Canal. Other vessels traverse its deep blue waters carrying cargoes between the Caribbean ports of South and Central America or from these to the United States.

The sea, 756,000 square miles in area, is a great arm of the Atlantic Ocean between the long, sweeping crescent of the West Indies and the coasts of Central and South America. Its length from Yucatán to Trinidad is about 1,900 miles; its width from the Panama Canal to Cape Maisi, Cuba, about 800 miles. The Caribbean and its bordering lands lie wholly within the tropics. Its bed is a vast undersea mountain system whose easternmost range breaks the surface to form the West Indies chain of islands.

The climate of the Caribbean lands is generally hot and wet. Over much of the region the average temperature is about 80° F. and it varies little from month to month. East and northeast trade winds blow almost uniformly throughout the year (*see* Winds). These bring heavy rains to the windward mountain slopes but leave some areas on the leeward sides relatively dry. Despite the heavy rainfall, sunshine is abundant. Much of the rain falls in brief, torrential showers. Violent cyclonic storms called hurricanes develop over the Caribbean and do great damage as they swing northward (*see* Storms). They are frequent from August through October and make shipping hazardous during those months.

The Caribbean lands were colonized early by the Spanish, English, French, Dutch, and Danish. Attempts to enslave the warlike native Caribs failed, and so African slaves were brought in to work the colonial plantations. Today Negroes outnumber whites by as much as 20 to 1 on some islands.

In the 17th and 18th centuries pirates infested the Caribbean. The Spanish Main (north coast of South America) was a favorite haunt for preying on the richly loaded ships of the king of Spain. The word buccaneer refers particularly to these Caribbean pirates of colonial days. (*See also* Pirates.)

In modern times the United States has played a large part in the fortunes of the Caribbean lands. After the formulation of the Monroe Doctrine in 1823, the United States took on the responsibility of keeping order in the region and of helping its peoples to improve their condition (*see* Monroe Doctrine). It liberated Cuba from Spain; intervened to bring order in Haiti, the Dominican Republic, Nicaragua, and Honduras; acquired Puerto Rico and the Virgin Islands; and built the Panama Canal.

Today the Caribbean is vital to the nation's two-ocean defense because it controls the Panama Canal approaches. There are bases for land, sea, and air forces at San Juan and Culebra, Puerto Rico; Guantánamo, Cuba; Coco Solo, Canal Zone; and other points. In 1940 bases were leased from Great Britain on several Caribbean islands. (*See also* Central America; West Indies.)

CARIBOU. The wild reindeer of North America, or caribou, lacks the symmetry and grace of a true deer. The body is heavy and the legs thick and sturdy with broad hoofs. Both males and females have large irregularly branching antlers, but these are smaller and more slender in the females.

Caribou feed on grasses and lichens and also browse on twigs and brush. There are two species. The woodland caribou once lived in swampy forests from Alaska and Canada to northern Maine and Minnesota and in the Rocky Mountain region of Idaho and Wyoming. Hunters forced them north. The last band south of Canada disappeared about 1925 from Isle Royale, in Lake Superior. The Barren Ground caribou resembles its woodland relative but is smaller and paler in color. It roams the desolate Arctic barrens and tundras beyond the limit of trees. Early explorers in Alaska found herds numbering hundreds of thousands.

When alarmed, caribou break into a clumsy gallop which changes to a steady shambling trot that carries them rapidly across country. Their large spreading hoofs, with sharp cup-shaped edges, give them a firm footing on the soft hummocky surface of their summer haunts and on the ice and snow in winter.

The scientific name of the woodland caribou is *Rangifer caribou;* of the Barren Ground caribou, *Rangifer arcticus.* (*See also* Deer; Reindeer.)

CARLYLE, THOMAS (1795–1881). This author's masterpiece, 'Sartor Resartus', is one of the strangest books ever written. It purports to be part book review and part biography. Carlyle said that he patched together his book from another book, 'The History of Clothes, Their Origin and Influence', and from the life of its author, Herr Diogenes Teufelsdröckh. The Latin title means "the tailor patched" and refers to this literary patching.

Both the German professor and his book existed only in Carlyle's imagination. But in the professor's name he poured out his own soul. Teufelsdröckh's spiritual struggles, loves, and hates were Carlyle's own. The book is written in a rhapsodic, broken style that has since been called "Carlylese."

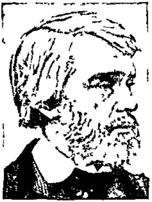
Thomas Carlyle, the eldest son of a Scottish peasant family, was born in the lowland village of Ecclefechan in 1795. He was first educated at home, then at the grammar school of Annan nearby. At the age of 14 he went to Edinburgh University; but he left in 1814 without a degree. He was too independent in spirit to get much from a university of that day.

For the next 12 years he eked out a living by writing and teaching. He became tremendously interested in German romantic literature, particularly the works of Schiller and Goethe. Much of his writing at this period dealt with this literature.

When he was still in his 20's he began to suffer from a stomach ailment, and for the rest of his long

life he was almost constantly in pain He was by nature irritable and stubborn The tortures of this disease made him even more ill tempered

In 1821 he was introduced to Jane Welsh, a young Scottish lady. She and Carlyle fell in love and after five years were married They were both somewhat hotheaded and their marriage was stormy But they remained deeply in love all their lives


THOMAS CARLYLE

In 1834 the Carlyles moved to London, taking the house in Chelsea where they lived until their deaths The following year 'Sartor Resartus' was published in Boston, *Mass Ralph Waldo* Emerson one of Carlyle's earliest disciples, had the book published in America because no British book publisher would accept it

Through his friend John Stuart Mill, the English philosopher, Carlyle became interested in the French Revolution and set to work on a monumental history After five months of difficult work he completed the first volume and left it with Mill for criticism

While in Mill's possession, the manuscript was accidentally burned by a servant girl lighting a fire Mill was appalled when he discovered the loss and rushed to Carlyle's house nearly frantic with grief Carlyle did not utter a word of reproach but tried only to console his friend After Mill had left, he said to Mrs Carlyle, "Mill, poor fellow, is terribly cut up We must endeavor to hide from him how very serious this business is for us"

The three volumes of 'The French Revolution' were finally published in 1837 The book was immediately successful The days of struggle were over, and Carlyle took his place as a leading English writer His other books followed one another at intervals of two to five years

Carlyle was profoundly shaken by the sudden death of his wife in 1866 After this time he wrote very little His physical strength gradually failed during those years and he died peacefully at the age of 85

Carlyle had a few "messages" which he repeated again and again He affirmed that work of *all* kinds is dignified and sacred He thought that men must renounce personal happiness to obtain peace of mind He believed that the world must be governed by "heroes" —strong, just men; consequently he *felt that the* people should put their faith in such men and not in democracy In his own day Carlyle exerted a strong influence on other writers, but today few people read Carlyle for what he had to say They read his books for their majestic style and revealing flashes of Carlyle's highly individual personality.

Carlyle's chief works are Life of Schiller (1823–24), 'Sartor Resartus' (1833–34) 'French Revolution' (1837) 'Heroes and Hero-Worship' (1841), Past and Present' (1843) 'Life and Letters of Oliver Cromwell (1845) 'Latter Day Pamphlets (1850) 'Frederick the Great' (1858–65).

CARNATION. The name "carnation" means "flesh-colored" *for that was the hue of the original flower.* Originally this spicy flower grew wild in the Mediterranean region It has been cultivated there for more than 2 000 years and is still the favorite flower of the Mediterranean countries It is also called clove pink because of its odor, but some botanists use this name only for single varieties

Early in the 16th century, growers developed deep red and white varieties Hundreds of others soon followed, and the carnation became one of the most popular flowers of Shakespeare's day He speaks of "our carnations and streak'd gilliflowers" (another name for the carnation) as the "fairest flowers o' the season" Many 16th century painters liked to include carnations in their portraits and interiors

The earliest hybrids developed, the wine-red and white, are still the most popular varieties along with the original pink We now have many hundreds of varieties. The colors run from deep red through white, and there are also yellow shades Some varieties are striped Blooms range in size from tiny buttons to great heads 4½ inches across The petals are both fringed and plain Single carnations have five petals, but doubles have a great many, closely packed

GARDEN CARNATIONS


Cultivated since the time of the ancient Greeks, the perennial border carnation has always been a favorite Its spicy blooms are colorful and long lasting

Most important hothouse varieties of carnations belong to the perpetual-flowering ("tree") strain They are tall, stiff stemmed plants with large blooms French growers started developing them in the 1840's Today most of the carnations in florists' shops are American hybrids

The flower-garden carnation is a very satisfactory perennial. The same range of colors is available, in both dwarf and large varieties Many bloom the same year from seed *sown early in the* spring They require no unusual care, but benefit from a rich, light soil and plenty of moisture *In* regions of severe winters plants should be protected with a light mulch after the ground freezes (*see* Gardens) But they often survive without protection

Scientific name of carnation *Dianthus caryophyllus* It composes one species of the pink genus The solitary terminal flowers are perfumed and variously colored They grow on a more or less erect branching stem from 2 to 3½ feet high with dusty, opposite grasslike leaves. (*See* Pink.)

CARNEGIE (*kär-nĕg'ĭ*), ANDREW (1835–1919). The history of this industrialist and philanthropist is one of the great American success stories. At 12, he was an immigrant boy earning $1.20 a week. Fifty years later he was giving away a third of a billion dollars of his own money. Meanwhile he had built up one of the world's greatest steel companies.


ANDREW CARNEGIE

Andrew Carnegie was born at Dunfermline near Edinburgh, Scotland. In 1848 the family came to America, settling at Allegany, Pa. (now part of Pittsburgh). Andrew worked first as a bobbin boy in a cotton mill. Later he became secretary to the superintendent of the Pennsylvania Railroad's Pittsburgh division. By the outbreak of the Civil War he himself was superintendent. He had also become a financier. Saving his earnings, he bought an eighth interest in a sleeping-car company. The stock increased greatly in value when the railroads adopted sleeping cars, and young Carnegie made a great deal of money.

During the war he gave up his position to take charge of the eastern military railroads and telegraph lines for the government. After the war he foresaw that iron bridges would soon replace wooden structures. So he founded the Keystone Bridge Works, which built the first iron bridge across the Ohio River. This business led him to found the iron and steel works which brought him the bulk of his huge fortune.

By 1899, Carnegie had consolidated many of the steel works around Pittsburgh into the great Carnegie Steel Company. Two years later, at the height of his phenomenal business career, he transferred his 500-million-dollar steel interests to the new United States Steel Corporation. He then retired from business to devote his time and money to public service.

Carnegie believed that it was the solemn duty of a rich man to redistribute his wealth in the public interest. He also felt that indiscriminate giving was bad. "No person," he said, "and no community can be permanently helped except by their own coöperation."

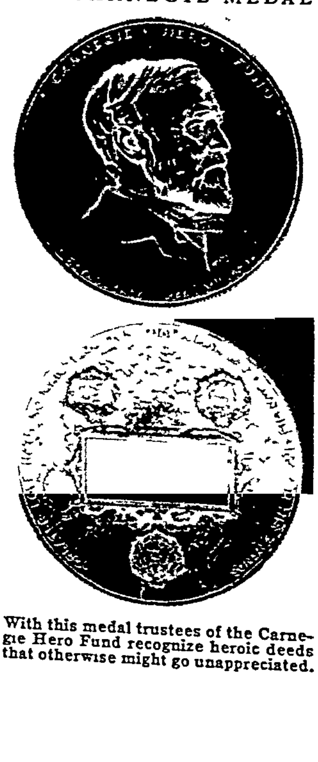
To insure that his money would be distributed wisely, he established the Carnegie Corporation of New York, with an endowment of $125,000,000. The income from this fund now goes to many causes. His biggest gift for any single purpose was the fund for establishing the Carnegie public libraries. Almost as famous are the Hero Funds he set up in many countries. The largest is for the United States and Canada (including Newfoundland). Most of his fortune went to educational and scientific institutions. Many of these he founded himself.

Carnegie was devoted to his mother and supported her in luxurious fashion. He did not marry until after her death when he was in his 50's. He and his wife bought a huge estate in Scotland and built a great house they called Skibo Castle. In his later years he was half-humorously known as the "Laird of Skibo." Carnegie died at "Shadowbrook," his summer home in Lenox, Mass., at the age of 83.

Following is the Carnegie Corporation's official summary of his public gifts and bequests:

Free Public Library Buildings	$ 43,068,838
Church organs	4,492,669
Colleges, universities, and schools	15,043,477
Carnegie Corporation of New York	135,336,867
Carnegie Institution of Washington	22,000,000
Carnegie Institute (of Pittsburgh)	11,729,471
Carnegie Institute of Technology	7,274,371
Carnegie Foundation for the Advancement of Teaching	15,000,000
Carnegie Hero Funds	10,540,000
Carnegie Endowment for International Peace	10,000,000
Church Peace Union	2,000,000
Palace of Peace at the Hague	1,500,000
Pan American Union Building	850,000
Other gifts and bequests	54,463,767
Total	$333,299,460

THE CARNEGIE MEDAL



With this medal trustees of the Carnegie Hero Fund recognize heroic deeds that otherwise might go unappreciated.

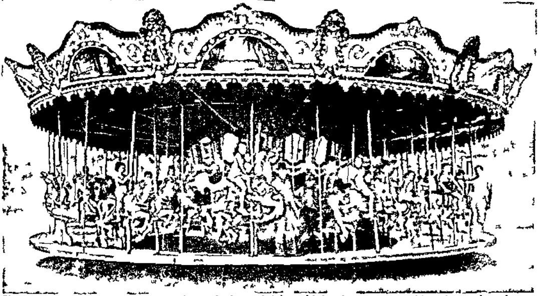
CARNIVAL. When the carnival comes to town, a weed-grown vacant lot blossoms overnight into an amusement park and magic wonderland. The traveling company unloads its equipment from railway cars or trucks, and soon a town of show tents and wooden booths arises. Workmen set up strong steel frames for the merry-go-round, the Ferris wheel, and rides that whirl and toss giddy, shrieking riders.

The carnival's medley of strange sights, sounds, and scents spells glamor and excitement for the children. They are fascinated by the brilliant lights and the bright colors of side-show costumes and cheap wheel-of-chance prizes. The blare of the calliope and the loud voices of barkers, the smell of hotdogs, the cotton candy, and the surging crowd pressing past the amusements on the midway add to the excitement.

Growth of the Modern Carnival

The modern carnival follows centuries of development. Strolling players entertained street crowds in

THE CHILDREN'S FAVORITE RIDE IN CARNIVALS EVERYWHERE



These happy American children cling to prancing wooden horses that rise and fall as the merry-go-round turns to a mechanical organ tune. The English call the merry-go-round a roundabout. In France, where it was first made 300 years ago, it is named a carrousel.

ancient Egypt, Greece, and Rome. When the religious festivals of the Middle Ages brought throngs of people to European city squares and plazas, shows came too. Street vendors and sweetmeat sellers mingled with the folk, while jugglers, clowns, acrobats, singers, and dancers amused them.

The word "carnival" originally was the name given the season of merrymaking held on the three days before Lent in Roman Catholic cities (*see* Easter). Among the most famous are the New Orleans Mardi Gras and carnivals in Rio de Janeiro and in Binche (Belgium). Each has a procession of gay floats and costumed marchers.

Traveling carnivals are popular in the Occident and Orient alike. They were especially beloved in American small towns before motion pictures, automobiles, and parks gave people access to organized entertainment. Carnivals continue to delight American crowds today, even in cities with many rival attractions.

The Carnies and Their Business

Carnival barkers, operators, and performers seem reckless, romantic folk to staring small-town youngsters. They speak a strange slang in which small outfits are "gillies" or "40-milers," lemonade stands are "juice joints," and balloon venders are "bag men." But many "carnies" are shrewd business men and women. They survey the financial condition of a community before renting the lot or posting the colorful show bills. They may obtain the sponsorship of local churches or charitable groups to gain good will and draw crowds. Carnival receipts are high in prosperous times. Even small outfits may go into winter quarters with a $150,000 profit.

A TENT SHOW BARKER

This barker has gathered a curious crowd by shouting the wonders of the [illegible] and refined exhibits in his freak show. Notice that he uses a microphone.

The largest carnival firms book their shows at state fairs, resorts, beaches, and the like. They travel by rail, using as many as 60 freight cars and Pullmans for their performers. They may carry 500 people. The smallest outfits travel by truck. They may have less than a dozen attractions and be operated by fewer than 75 people. Food booths and games of chance are sometimes run by separate owners on concessions.

Origin of Merry-Go-Rounds and Ferris Wheels

Carnival owners frequently introduce new rides that appear dangerous and exciting

but nothing displaces the merry-go-round and the Ferris wheel as favorites. The merry-go-round goes back to the early 18th century. Its French name, *carrousel*, was that of a tournament entertainment popular in Italy and France in the 17th century. In these performances troops of costumed horsemen engaged in contests, drills, and pageants. The Place du Carrousel, between the Louvre and the Tuileries Garden in Paris, was named for a magnificent carrousel given there by Louis XIV in 1662.

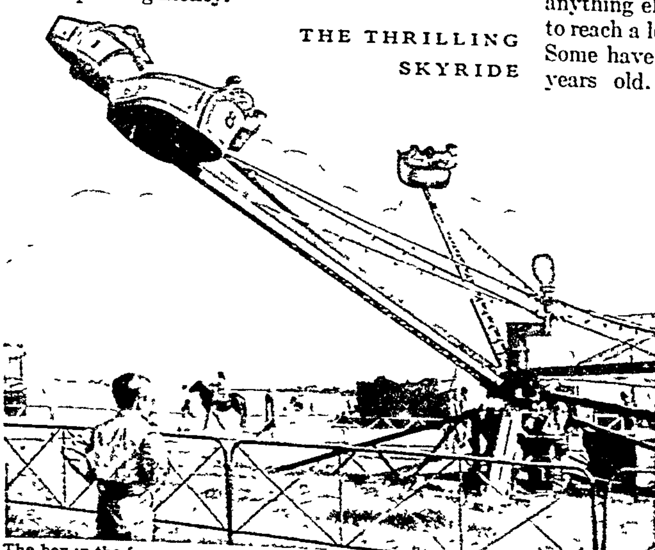
Only the nobility could enjoy these spectacles and so a Parisian toy maker set hobby horses on a platform to create a make-believe carrousel. It was crudely made and the platform turned slowly with only manpower or horsepower to move it; but it delighted people from the first. (Further details of the development of the merry-go-round are uncertain or unknown.) Modern merry-go-rounds are whirled by motors; but many of them still carry prancing wooden ponies wearing the fancy harness of tournament mounts.

The first Ferris wheel was 250 feet in diameter and held a thousand riders. It was built for the World's Columbian Exposition held in Chicago in 1893. Carnival wheels are much smaller but they seem sky-high to youthful riders.

Shows and Games of Chance

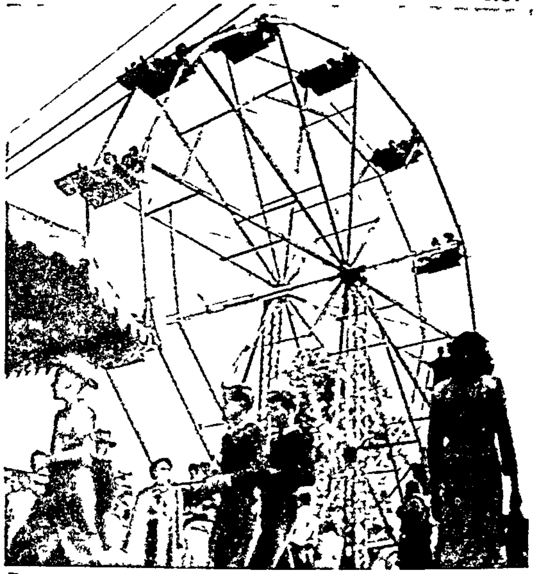
The carnival's varied shows usually include minstrels, girl shows, freak acts, and animal or snake exhibits. A barker outside the tent ballyhoos the performance inside and calls out the dancing girls or minstrel men to parade across an outer platform. This "opening show" is a tantalizing sample, designed to start the crowd toward the ticket window. Free shows, such as a tightrope act or a fireworks display, are offered late in the evening to keep the crowd at the lot spending money.

THE THRILLING SKYRIDE



The boy in the foreground is probably wondering whether he would be scared in the small car whirling high overhead. Carnivals vie with one another in offering rides that appear exciting but are not actually dangerous.

HOW FAR AWAY THE GROUND LOOKS!



Ferris wheels delight children and adults alike. They offer the thrill of flying—and the support of strong steel girders.

Many games-of-chance entice people to risk their dimes and quarters. Shrill barkers constantly urge the customers to pick a lucky number on a whirling wheel or to toss a ball or a ring at a target. These games are built to bring profit to their operators, and the winners are few. Even the lucky folk get little for their money, since they usually carry away tawdry, useless prizes.

Carp

Carp. One of the most widely distributed fishes in fresh-water rivers and lakes is the common carp. It lives on the bottom, grubbing up plants, insects, and anything else it finds to eat. Carp have been known to reach a length of 4½ feet and a weight of 80 pounds. Some have been thought to be more than a hundred years old. The specimens usually caught, however, are under 10 years old, measure between 1 and 2 feet, and weigh from 2 to 10 pounds.

Although their flesh is coarse, carp are eaten by many people who have learned to cook and season them to their taste. Millions of pounds a year are shipped from the Mississippi basin and the Great Lakes to the fish markets of large eastern cities. In Europe and Asia, carp are often raised in ponds.

Carp sometimes crowd out more valuable fish by muddying the water, interfering with their feeding, and eating their eggs. They are called "rough" fish by sport fishermen. Their habit of uprooting vegetation keeps ducks away from ponds. It is difficult to get rid of them since they are able to live and breed in muddy and polluted water and to survive extreme changes in

temperature In spring their numbers may be greatly reduced by commercial fishermen who net and spear them as they swim into shallow water to spawn Enough slip by to produce multitudes of young A female deposits many thousands of eggs during April May and June The eggs clinging in sticky clusters to aquatic plants and debris hatch out in 6 to 12 days The young carp that manage to escape the jaws of bass and other fish develop very rapidly Under ideal conditions they may weigh more than one-half pound before they are a year old and at the age of four they may measure 20 inches and weigh 5½ pounds

The carp has a blunt nose and a small thick lipped mouth Two pairs of feelers called barbels dangle from the upper lip The wide heavy body is covered *with large scales The back is olive green in color* the sides a dusky gold and the belly a bright yellow In addition to this so-called *scale carp* we find two other common varieties The *mirror carp* has three or four rows of huge scales along each side of its body but is otherwise bare The *leather carp* is entirely bare except for a few scales found occasionally on its back

Originally the carp lived in Asia Early in the 13th century it was introduced into Europe Although it was not brought to the United States until 1876 it is already established in nearly all parts of the country

The common carp (*Cyprinus carpio*) also called European carp and German carp has numerous relatives making up the carp or minnow family (*Cyprinidae*) To this family belong the goldfish shiner chub and dace (*see* Dace Goldfish) Resembling the carp in habits are the buffalo fish and the suckers (family *Catostomidae*)

CARPA'THIAN MOUNTAINS Next to the Alps the Carpathian Range is the most important mountain barrier of Europe Lying across south Central Europe like a great sickle it holds the broad and fertile Hungarian lowlands within its curve The tip of the sickle points southwest across the narrow Danube Valley toward Vienna and the Alps beyond From here the range curves gently east and south into central Rumania There the southern extension which is *often called the Transylvanian Alps*, hooks sharply west to the Iron Gate This is a spectacular narrow *gorge cut through the mountains* by the Danube River on its way to the Black Sea Below the Iron Gate the Balkan Range swings south to form the handle of the sickle

The Carpathians are cut by many passes The most famous of these is the historic Pass of the Tatars in the western Ukraine Through this pass the Golden Horde of the khans poured into Hungary in A D 1241 and ravaged much of Central Europe (*see* Mongols)

The inside of the Carpathian sickle is drained by the Danube The outer slope drains to the Baltic Sea by the Oder and the Vistula and to the Black Sea by the Dniester the Prut and the Siret

The lower slopes on each side support dense forests of giant pines Only grayish mosses and silvery lichens cling to the rugged granite peaks which are covered with snow for about nine months of the year On some of the mountain tops are small sea blue salt lakes which the people call eyes of the sea Some of these peaks are more than 8 000 feet high but in general the elevations are only from 3 000 to 5 000 feet In the forests wild beasts—bears wolves and lynxes—still roam and great eagles soar through the sky

All through these mountains are great mining shafts for some of the richest mineral deposits of Europe lie in this district Gold and silver are found in quantities as well as copper lead zinc iron coal and petroleum Great veins of salt underlie the upland plateaus sometimes reaching a thickness of 600 feet Tunnels riddle these deposits for mile after mile *Mining forestry and farming furnish occupations for* many of the mountain people Grain and vegetables are raised in the valleys and orchards cling to the steep sides of sunny slopes (For maps of the Carpathians *see* Danube River Czechoslovakia Europe)

CARROLL LEWIS (1832 1898) Through all the delightful nonsense of Lewis Carroll s Alice s Adventures in Wonderland and Through the Looking Glass runs a strong vein of sense Both the sense and the nonsense came naturally to Lewis Carroll whose real name was Charles Lutwidge Dodgson As a professor of mathematics at Oxford University he was a dry and exacting teacher Outside the classroom his brimming sense of humor made him a beloved friend of many children

Charles Dodgson was born Jan 27 1832 at Daresbury in Cheshire England His father was a clergyman and Charles was the eldest of 11 children The family lived on a glebe farm (one owned by the church) *outside the town The four brothers and seven sisters* had all sorts of family games notably a train game around the garden for which Charles wrote elaborate rules When he was 12 years old he was sent to school at nearby Rutland and two years later he entered Rugby one of England s oldest and most famous boys schools There he earned good grades in classic languages and mathematics as well as a reputation for defending himself with his fists

When he was 18 Charles entered Christ Church College Oxford University where he studied worked and lived for the rest of his life There he took his bachelor s and master s degrees was ordained a deacon of the Church of England and taught mathematics to several generations of Oxford students He never married He lived in one of the college halls and his few adult friends were mainly fellow faculty members His hobbies were mathematical puzzles and photography He had his own darkroom *and his pictures even by today's standards,* were of excellent quality Except for a European journey that included a six weeks stay in Russia he traveled little

Lewis Carroll always loved children He gave parties for them and took them to the theater and on picnics On one such picnic his guests were Alice Lorina and Edith, the daughters of Dr Henry

ALICE HEARS A MELANCHOLY TALE

"'Once', said the Mock Turtle at last, with a deep sigh, 'I was a real turtle'." Here he is, telling Alice and the Gryphon the sad story of his life. Sir John Tenniel's illustrations have delighted generations of Lewis Carroll's readers.

Liddell, dean of Christ Church College. On this hot summer day in a meadow along the Isis River he began to tell them the 'Alice' stories. Later he wrote them out for the children, and the manuscript tales were read and reread by many people. In 1864 'Alice's Adventures in Wonderland' was published, and 'Through the Looking Glass' in 1871. Both were illustrated by the famous cartoonist and artist Sir John Tenniel, whose drawings have remained as popular as Lewis Carroll's stories.

In 1876 he published 'The Hunting of the Snark', the amusing subtitle of which is 'An Agony in Eight Fits'. Other important children's books written by him were 'Sylvie and Bruno' (1889), and 'Sylvie and Bruno Concluded' (1893). To these books he signed his pen name; for several other works on mathematics and logic he used his real name. His book royalties enabled him to teach fewer classes, and he spent his summers at Eastbourne on the seacoast. He died Jan. 14, 1898.

CARROTS. In the summer many fields seem to be dotted with huge, lacy snowflakes. The "flakes" are really the blossoms of the wild carrot. A common name for the plant is Queen Anne's lace. (*See also* Queen Anne's Lace; for picture in color, *see* Flowers.)

The carrots we eat are cultivated varieties of the same plant. Men have grown them for food since ancient times. Hollanders brought them to England during the reign of Queen Elizabeth I. A few years later women wore the feathery leaves in their headdresses. Today carrots are grown everywhere in the United States, both on farms and in home gardens. They are eaten either raw or cooked.

If we cut a carrot across, we see the true root as a central core. Around the core is a fleshy part with food for flowers and seed. If left for the winter, the next year the stem will grow two or three feet high. This bears flowers in "umbrellas," or *umbels*.

Carrots differ widely in the shape and color of their roots. White carrots are grown chiefly for cattle, and red, orange, or yellow for table use. There are early, medium, and late varieties, and, like potatoes, carrots are found in our markets the year round. Table varieties may be sown as soon as the weather settles in spring. Stock carrots mature late, growing best during the cool weather of the fall. They require a loose soil that will allow the roots to expand, preferably a rich sandy loam. Carrots contain valuable food minerals and are rich in vitamin A (*see* Vitamins).

The carrot is a biennial belonging to the parsley family (*Umbelliferae*). Scientific name, *Daucus carota*.

KIT CARSON—HERO *of the* OLD WEST

CARSON, CHRISTOPHER (KIT) (1809–1868). The opening of the West gave America many notable heroes. One of the greatest of these pioneers was Kit Carson. Carson's long career spanned many activities. He was fur trapper, guide, Indian agent, and soldier. In all these, he showed himself to be a fearless man of the wilderness, with the strength of rawhide and the patient wisdom of an Indian. White men chose him as their leader; and several tribes of Indians regarded him as protector and friend.

Carson was John C. Frémont's guide and companion on the explorations that opened the Oregon country to settlement and brought California into the Union. Frémont admired Kit's knowledge of the wilderness, his instinct for finding game and passable trails, and his determination to go on when weaker men would have turned back. In his official reports, Frémont told of Carson's strength and daring on the expeditions (*see* Frémont). People in the East read the reports, and Kit soon ranked with Daniel Boone as one of the nation's great pioneers.

Boyhood in the Missouri Wilds

Kit Carson's father had come to Kentucky from South Carolina, and the boy was born Christmas Eve, 1809, in Madison County, Ky. He was the ninth of 14 children. When Kit was about a year and a half old, the family moved to Missouri (then part of the Louisiana Territory). They settled in the Boone's Lick district, an area that later became Howard County, Mo. At that time Indian raids were frequent.

Kit was the smallest boy in the family. All his brothers grew to more than six feet in height, but Kit never topped five feet six inches. Even though he was small, Kit early learned wilderness ways. He

CARSON LEADS FREMONT OVER THE SIERRA NEVADA

On John C Frémont s second expedition Kit Carson guided the party over the rugged Sierra Nevada in midwinter Here Carson leads and points the way to Frémont close behind Frémont relied upon his able guide in the unmapped country

stood guard against Indian attacks and he was an expert shot with the muzzle-loading rifle By the time he was eight he could drill a squirrel at 50 yards And in 30 seconds he could drop a new lead bullet down the bore tamp it into place spill the right quantity of powder into the pan place the cap and be ready to fire again Few boys in Boone s Lick learned to read and write and Kit was not one of them

When Kit was nine his father was killed by a falling tree limb The boy had his freedom for a few more years When he was 15 his mother apprenticed him to a saddler and harness maker in the near by town of Franklin

Cavy Boy on the Santa Fe Trail

Kit chafed at being kept indoors over a saddler s bench He missed the hunting and the rolling wooded land along the Missouri River And from wagon drivers and hunters who stopped by the shop he heard tales of adventure These men traveled with the great wagon trains that carried goods over the Santa Fe Trail After a year Kit could stand confinement no more so he ran away

He asked a wagon boss for a job and was laughed at You re too small the wagon boss said We need real men on the trail But Kit kept begging and finally he was made a *cavy boy* one who drove the spare mules and oxen

Although accustomed to outdoor life Kit had to endure greater hardship than he had ever known As the wagon trains pushed slowly forward through desert dust Kit suffered extreme thirst They kept moving all day long and at night the men shared watches On one occasion Kit helped amputate the shattered arm of an injured man The boy grew lean and strong and he began to love the new life

Kit Becomes a Mountain Man

From Santa Fe Kit went to Taos He worked as a cook and errand boy and helped repair harnesses and other leather articles Here he met an adventurous breed of men—the Rocky Mountain fur trappers called Mountain Men They wore moccasins and buckskin suits and lived in buffalo-skin lodges on the trail They were like Indians in their way of life

Kit was keen to become a Mountain Man and when he was 19 he got his chance In 1829 Ewing Young a pioneer trapper hired him for his trapping expedition to California Kit soon proved himself worthy In fighting Indians and in crossing mountain streams and the parched Mojave Desert Kit showed his bravery and endurance He became Young s right-hand man

He returned to Taos in 1831 and that fall he was hired by Thomas Fitzpatrick to trap for beaver in the mountains of the north Over the next several years he became one of the leading Mountain Men When the Blackfeet attacked his parties Kit planned the battle tactics that defeated them At Fort Robidou he received his only serious wound His shoulder was shattered by an Indian bullet

When the price of beaver plews (pelts) dropped Kit became chief hunter for Bent s Fort in Colorado His job was to keep the fort supplied with meat About 1836 he married an Arapaho Indian girl They had one child Adaline Kit s wife died and after

a time he took his daughter east to Missouri and left her to be educated in a convent. It was the first time he had been home since he ran away.

Mapping the Trails with Frémont

Returning west, Carson met Lieut. John C. Frémont aboard a Missouri River steamboat. Frémont had been assigned the task of mapping and describing the Western trails. He had already heard of Kit, and he hired him as guide for the first expedition, which lasted from June to October of 1842.

Kit went back to Taos, and in 1843 he married a beautiful Mexican girl named Maria Josefa Jaramillo. Later in the year he joined Frémont's second expedition at the Arkansas River. His old employer, Thomas Fitzpatrick, also went along as guide. On this trip Carson led the party across the high Sierra Nevada in midwinter. From a point near present-day Virginia City, Nev., Frémont's party crossed the mountains and descended into the Sacramento Valley of California.

KIT CARSON

Mountain Man and soldier, Carson was an American hero.

In 1845 Carson again accompanied Frémont on his third expedition. The party left Bent's Fort on August 26, and by the time they reached California word came that the United States was at war with Mexico. Frémont aided the American colonists in land battles, and coöperated with the navy in capturing California for the United States. Carson served ably under Frémont. After the capture of Los Angeles, Frémont appointed Carson a lieutenant on special service and sent him east to Washington with dispatches for President Polk.

But at Socorro, N.M., Carson met an army group led by Gen. Stephen W. Kearny. Despite the fact that Carson was under orders to deliver his dispatches, Kearny forced him to guide the army back to California. The country was still alive with Mexican troops and Kit feared an ambush.

Kearny failed to heed Kit's warning, and on Dec. 6, 1846, they were attacked by Mexicans at San Pasqual, about 30 miles from San Diego, Calif. On the third night of the battle, Carson, accompanied by Lieut. E. F. Beale and a Delaware Indian scout, crept through the enemy lines and ran the whole distance to San Diego. There they enlisted help for Kearny's besieged forces.

In March 1847 Carson again was sent to Washington with dispatches. With a small party he crossed the continent in three months. In Washington Carson was acclaimed a great hero. President Polk appointed him a lieutenant in the Mounted Rifle Corps. He returned to California, and once again was sent to Washington with dispatches.

At Santa Fe he learned that the Senate had voted down his commission as lieutenant. This refusal was the result of a political feud between a large group of senators and a smaller one headed by Sen. Thomas H. Benton, Frémont's father-in-law. The senators who voted against him wanted to spite Benton, not Carson. Carson completed his mission and returned to Taos as a private citizen.

Carson settled down with his wife to a life of ranching and farming. In the summer of 1853, aided by his Mexican herders, he drove 6,500 sheep to Sacramento, Calif., a distance of about 800 miles. He sold the sheep for $5.50 a head and made a good profit. The next year he was appointed Indian agent at Taos for two tribes of Ute Indians. Carson could not read at all, and he could write only his own name. Yet he was an able administrator. The Indians trusted him and called him *Vi-hiu-nis*—"Little Chief." Occasionally he served the army as scout in clashes with warring Apaches.

Part of Carson's success as an Indian agent was due to his simple code of honesty. Frémont had written of him, "With me Carson and truth are one." Later Gen. William T. Sherman described Carson's integrity as "simply perfect." The Indians also admired him for his love of children. Kit had seven of his own, and he was a good friend to all the Indian children under his charge.

Service in the Civil War

When the Civil War broke out Carson resigned his post as Indian agent at Taos and helped organize the 1st New Mexican Volunteer Infantry regiment of the Union Army. He was elected lieutenant colonel and later rose to colonel. Such elections were customary in volunteer regiments. During his Civil War service Carson at last learned to read and write. His long experience with Indian fighting made him a brilliant tactical leader.

Kit's force operated against the Apaches and Navajos and later against the Kiowas and the Comanches. His defeat of the Navajos turned them toward ways of peace after two centuries of almost constant warfare. He won a victory at Valverde, but at Adobe Wells in northwest Texas he had to withdraw after his 400 men met a superior force of thousands of Indians. In 1865 he was given a brevet commission as brigadier general and was cited for gallantry and distinguished service. In the summer of 1866 he took command of Fort Garland in western Colorado. Ill health from an old injury forced his resignation the next year.

In 1868 the Carson family moved to Boggsville, Colo., near present-day La Junta. Kit was still very sick, but he went to Washington with a group of Utes. They had asked him to help plead their case before a grievances commission. He visited doctors in New York City and Boston, seeking relief from his illness. But they were unable to help him and Kit returned home. His wife died April 23, 1868, and Kit was taken to the army doctors at Fort Lyons for care. He died there on May 23, 1868.

CARSON CITY, NEV The smallest state capital is Carson City It is pleasantly situated in western Nevada's Eagle Valley near the bottom of the eastern slope of the Sierra Nevada Lake Tahoe is some 14 miles west, Reno is about 30 miles north

State offices federal agencies and rail workshops employ the majority of the city s workers The surrounding area has cattle and sheep ranches irrigated farms, and mines The capitol begun in 1870 as a square stone structure with huge log rafters is set in a four block elm shaded park The State Museum is housed in the Old Mint Building a branch of the national mint from 1870 to 1893 Two miles east of the city is the Nevada State Prison On the prison property fossil skeletons of mastodons and other prehistoric life have been found

The site of Carson City lay on the Overland Trail over which stages and the Pony Express traveled to Sacramento and San Francisco Calif Abraham Curry surveyed the present site Major William Ormsby an early comer, proposed the name Carson City, after the famous frontier scout (*see* Carson) The 1859 rush to the gold find at near by Virginia City stimulated the early growth of the settlement The population reached its peak of about 8 000 in the 1870 s

Carson City became the territorial capital in 1861 and the state capital when Nevada became a state in 1864 Here Bob Fitzsimmons defeated Jim Corbett for the heavyweight championship in 1897 Population (1950 census) 3 082 (*See also* Nevada)

CARTHAGE About a thousand years before Christ the Phoenicians established the city of Carthage on the edge of a region in North Africa now called Tunisia The city became the commercial center of the western Mediterranean and retained that position until overthrown by Rome

Tradition has it that Carthage was founded by Queen Dido after she fled from Tyre The inhabitants she found at the site agreed to give her as much land as she could compass with a single ox hide Dido cut the hide into thin strips and with the joined strips enclosed a large area There according to Vergil s Aeneid Aeneas visited her (*see* Aeneas, Phoenicians)

Carthage lay on a bay Its Phoenician settlers were seafarers and traders Aided by slave labor they built wharves markets factories and homes Carthage grew rich and strong Its merchant-sailors established colonies in North Africa in Spain and on the Mediterranean islands They traded with all the known world

Even after Rome mastered all Italy a Carthaginian boasted, " no Roman may even wash his hands in the Mediterranean Powerful Rome however over a period of a hundred years defeated Carthage in the three Punic Wars The first fought in Sicily (264 241 B C) cost Carthage Sicily and a large indemnity

In the second Punic War (218–201 B C) the Carthaginian general Hannibal with his ponderous and frightening war elephants crossed Spain and climbed over the Alps an almost unbelievable exploit to defeat the Romans at Cannae He failed however in his expectation of winning support from the Italians subjected by Rome Hannibal recalled to Africa to stand off the threat of the Roman Scipio Africanus the younger who was storming Carthage s own walls lost at Zama and Carthage was forced to surrender its navy and to withdraw from Spain (*see* Hannibal)

Carthage s power surged anew and again the Romans became fearful Cato a Roman senator thundered at the end of every speech—no matter what the subject *Delenda est Carthago* (Carthage must be destroyed) The third Punic War (149–146 B C) ended in Roman victory in spite of a heroic resistance in which Carthaginian women cut off their hair to provide bow strings for the catapults Carthage was razed

The emperor Augustus later built a new city on the site This became a Roman seat of government in Africa When the Vandals overran the region Carthage was made their capital It was destroyed again after its capture (647) by the Arabs Today a few hamlets and ruins mark the site

JACQUES CARTIER

From Saint Malo a Breton village in France Cartier sailed on the voyages that won Canada for France This portrait hangs in the town hall of Saint Malo

CARTIER (*kar tja'*) **JACQUES** (1491 1557) In the early 1500 s Jacques Cartier attempted to find a sea passage to the East Indies through North America He failed in this but he discovered the St Lawrence River and opened Canada to European settlement

Because Cartier wrote nothing of himself very little is known of him but that he was born in Saint-Malo France Dec 31 1491 and that he was a courageous Breton sea captain On the first of his voyages to North America he set sail from Saint-Malo April 20 1534

On May 10 he reached northern Newfoundland He passed through the Strait of Belle Isle and explored several islands and points along the shores of the Gulf of St Lawrence The Indians were friendly They eagerly traded their plentiful winter catch of furs for a few beads and some hatchets In the autumn two of them accompanied Cartier on his return voyage to France

On May 16 1535 Cartier sailed again from France This time he had three vessels He camped at a spot far up the St Lawrence that the Indians called Stadacona near the present site of Quebec He took his

smallest ship and two ship boats farther up the river to the place where it widens into Lake St. Peter. There his ship shoaled, and Cartier continued his exploration in the ship boats and afoot. He reached the fortified Indian village of Hochelaga, on an island (now Montreal) near where the Ottawa River flows from the north into the St. Lawrence. Cartier called the island's greatest height Mont Royal. He ascended the river until stopped by the Lachine ("China") Rapids He wintered at Stadacona, where because of hardships and poor food 25 of his 110 men died of scurvy In the spring, with 12 captured Indians, he returned to France

In 1541, with five ships and a party of colonists, he again sailed for the New World Jean François de la Roque, Sieur de Roberval, was the leader of the colonists The colony was not a success, and in 1543 Cartier again sailed to Canada to bring back de Roberval and his men. After this voyage Cartier retired to Saint-Malo, where he died Sept 1, 1557.

CARTWRIGHT, EDMUND (1743–1823) The Anglican clergyman Edmund Cartwright is celebrated as one of the men who brought about the Industrial Revolution. Although he had little mechanical knowledge, he invented the power loom. Thereafter he made other inventions, including a valuable wool-combing machine, and aided Robert Fulton with his steamboat.

EDMUND CARTWRIGHT

His invention helped start the Industrial Revolution.

Cartwright was born April 24, 1743, in Nottinghamshire and entered Oxford University when only 14 years old He won his M.A. degree in 1755 and became curate of the Brampton church. In 1779 he became rector at Goadby Marwood in Leicestershire. He married and had several children

When Cartwright was 41 he vacationed near Richard Arkwright's spinning mills in Crompton (*see* Arkwright). He saw that fast-weaving power looms were needed to use the yarn produced so abundantly by Arkwright's machines. In a year Cartwright built a patentable model of a loom. Later improvements were also patented.

A factory which Cartwright set up at Doncaster, Yorkshire, failed to make money. In 1791 a building containing 400 of his looms was burned, probably by hand weavers who feared the advent of power weaving. This and other losses plunged Cartwright into debt. He moved to a small house in London, where he continued to experiment.

In recognition of his contribution to the textile industry, Parliament in 1809 awarded him 10,000 pounds. He then bought a farm near Sevenoaks, Kent, where he carried on both agricultural and mechanical experiments. He died Oct. 30, 1823. (*See also* Industrial Revolution, Spinning and Weaving.)

CARUSO (*kä-rọ'zō*), **ENRICO** (1873–1921). One of the greatest opera singers of all time was the Italian tenor Enrico Caruso. His rich, warm voice was heard in nearly 70 operatic roles; his most famous were Rodolfo in Puccini's 'La Bohême' and Canio, the clown, in Leoncavallo's 'I Pagliacci'. He also enjoyed the role of Eléazar in Halévy's 'La Juive' because it required great dramatic as well as singing ability.

ENRICO CARUSO

Caruso's magnificent voice enthralled opera lovers.

Caruso was born Feb 25, 1873, in Naples, Italy. He was the 19th of 21 children. The family was poor; as a boy Caruso worked in a flour mill. He earned money for his music lessons by copying songs for other students He had little real training, and when he was 19 he was already touring Italy with a small opera company. In 1894 he made his official debut in Naples in 'L'Amico Francesco'. During the next few years he created the tenor roles in Giordano's 'Fedora', Cilea's 'Adriana Lecouvreur', and Franchetti's 'Germania'. His fame became international in 1902 when he scored a brilliant success with Melba at Monte Carlo and followed it with a great success at London's Covent Garden. In 1903 he made his American debut at the Metropolitan Opera House in New York City, where he sang the role of the duke in Verdi's 'Rigoletto'.

Always in demand at leading opera houses, Caruso sang in nearly every country of Europe and North and South America. His major roles were in French and Italian opera, but he learned seven languages, including Russian and Portuguese. He sang in the first radio broadcast from the Metropolitan Opera House in 1910 and was one of the first great singers to make phonograph recordings. He was talented at drawing caricatures; for a time, one of his drawings appeared in each issue of the Italian paper *La Follia*.

Caruso had two sons by the Italian soprano Ada Giochetti. In 1918 he married Dorothy Benjamin: they had one daughter. Caruso died in Naples on Aug. 2, 1921, of pleurisy.

CARVER, GEORGE WASHINGTON (1864?–1943). Toward the end of the Civil War a raiding army swept through southwest Missouri and kidnaped a slave baby and his mother from the farm of their master, Moses Carver, near Diamond Grove, close to Joplin. The baby, the future George Washington Carver, was restored to Mr. Carver by a bushwhacker in exchange for a race horse, which was valued at $300. He remained with the Carvers until he was ten years old, then went out to make his way in the world.

Too frail for work in the fields, he did house and garden work. He had a "green thumb" from the beginning and while still a child was called a "plant

doctor. Always he wanted to know things. At the age of 19 he entered high school at Minneapolis, Kan. From there he went to Simpson College at Indianola, Iowa, and then to the Iowa State College of Agriculture and Mechanic Arts at Ames, where he received a B.S. degree in agriculture in 1894 and an M.S. degree in 1896. He had paid for every step of his education by his own work.

His achievements brought him to the attention of Booker T. Washington, founder of Tuskegee Institute. Carver became head of Tuskegee's department of agriculture in 1896. In his 47 years there he did notable work in chemurgy and scientific agriculture. He made hundreds of useful products from peanuts, cotton, sweet potatoes, and clay (*see* Plant Life, subhead "What Men Do with Plants"). He showed Southern farmers that they could diversify their crops.

Carver was also a painter and musician. In 1940 he gave his life's savings toward establishing the George Washington Carver Foundation for research in agricultural chemistry. In 1953 his birthplace near Diamond Grove (now called Diamond, Mo.) was dedicated as a national monument.

CASCADE MOUNTAINS. The rugged magnificence of the Cascade Range extends about 650 miles from northern California through Oregon and Washington into British Columbia. The crest of the range lies from 100 to 150 miles back from the Pacific coast. The Cascades are a continuation of the Sierra Nevada, with the dividing line at the Feather River, a tributary of the Sacramento (*see* Sierra Nevada). At their northern extremity they merge with the Canadian Rockies.

The broad mass of these mountains is composed of igneous and volcanic rocks. Magnificent forests clothe their slopes, mostly evergreens such as the tamarack pine, cedar, and the great Douglas fir. Three rivers cut through the range to the sea—the Klamath to the south, the mighty Columbia near the middle, and the Fraser far to the north. The many cascades and rapids of the deep-gorged Columbia gave the mountains their name.

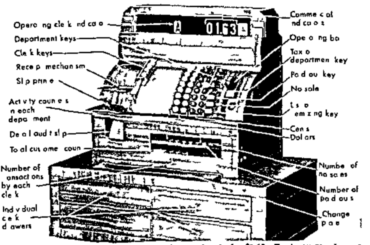
The most conspicuous peaks are Mount Rainier (14,408 ft.) and Mount Shasta (14,162 ft.). Other well-known summits are Mount Adams (12,307 ft.), Mount Hood (11,245 ft.), Mount Baker (10,750 ft.), Mount St. Helens (9,671 ft.), Mount McLoughlin (9,493 ft.), Mount Stuart (9,470 ft.), and Mount Scott (8,938 ft.). Lassen Peak in California (10,453 ft.) is the only active volcano in the United States. It was believed extinct until steam and ashes erupted from it in 1914. Mount Rainier and Lassen Peak gave their names to national parks (*see* National Parks).

CASHMERE. The name *cashmere* or *kashmir* is today used for a soft wool or rayon dress goods with fine diagonal ribs. True cashmere wool, soft and silky in texture, comes from the fleece of the Cashmere goat in the Himalayan region. The beautiful hand-woven Cashmere or Indian shawls originated in the Vale of Kashmir. (*See also* Goat; Kashmir.)

CASH REGISTER. In millions of business establishments the cash register is used to keep a record of sales. This invaluable aid to trade was invented in 1879 by James Ritty of Dayton, Ohio. On a steamer trip he watched the device that recorded the revolutions of the propeller shaft. He saw that a similar device might be used to record sales transactions. The machine was taken over in 1884 by John H. Patterson, who formed the National Cash Register Company. Patterson greatly improved the register. Later other companies developed similar machines.

The modern cash register is both an adding machine and a printing machine. Its mechanism gives a complete record of the day's business. It registers each sale and records the total, shows how much business each clerk has done, and shows who has made a mistake, how much money has been taken in, and how many "charge," "received on account," and "paid out" transactions have been handled. It issues a dated receipt for the customer that states the amount of the sale and the clerk's initial. Each amount is also recorded on a paper tape. The internal mechanism is similar to that of a calculating machine (*see* Calculating Machine).

HOW THE CASH REGISTER WORKS



Suppose you are a clerk and have just made a cash sale for $1.63. First you punch your own clerk key (in this case "A"), then the amount of the sale, and finally the operating bar. Your individual cash drawer will open, the sale will be recorded on the audit slip, and the slip printer will issue a receipt for the customer. The register also provides for noting from which department *the sale was made*, the tax added to the sale price, the number of customers, transactions by each clerk, "paid outs," and "no sales." The machine can act as an adding machine for totaling all the items in an individual sale.

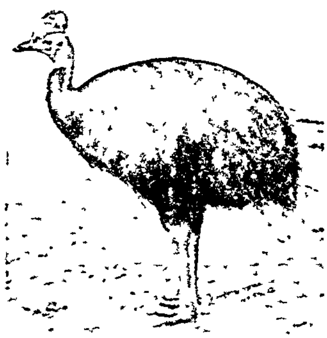
CASPIAN SEA. Lying on the boundary between Europe and Asia, the Caspian Sea is the largest salt lake and the greatest interior body of water in the world. Its area of nearly 170,000 square miles is more than five times that of Lake Superior. It is about 760 miles long and from 130 to 270 miles wide. Iran borders the south; Russia, the other three sides. Russia has the chief ports, notably Astrakhan, Derbent, Makhachkala, Krasnovodsk, and Baku, a great oil center on the Apsheron peninsula. Iran has the ports of Pahlevi and Bandar Shah. The narrow plain on the south leads up to the Elburz Mountains; that on the west, to the Caucasus Mountains. The northern shore is bordered by marshy steppes, and the eastern, by swamp and desert.

The landlocked sea is a shrunken remnant of an ocean which in earlier geologic times extended from the Black Sea to the Arctic Ocean. After it was cut off by the rise of the Caucasus Mountains on the west and the Urals to the north, it depended for water upon drainage from its tributary rivers, notably the Volga and the Ural. Today this drainage is not enough to keep it filled to sea level. The northern region is shallow, but the southern half reaches a depth of 3,224 feet.

Because the Caspian has no outlet, its level is affected by rain and drought. This fluctuating level is an index to the weather of past ages. Ruins of walls now under water indicate a former low level, hence long periods of drought. Terraces far back from the coast signify past cycles of heavy rainfall.

Numerous fresh-water as well as sea fish abound, for the Caspian is less salty than the ocean. Roach, sturgeon, salmon, carp, bream, tench, and pike are caught. The eggs of the sturgeon are salted for export as *caviar.* Fisheries and near-by oil wells give the Caspian some importance in international trade. By way of the Volga and its canals to other rivers, cargoes from the Caspian can reach the Black Sea on the west and the Baltic and White seas far to the north.

A BIRD WITH MIGHTY WEAPONS



This cassowary displays huge legs and claws, his chief weapons. He also uses beak and wings in fighting.

CAS'SOWARY. In the dense forests of Australia, New Guinea, or near-by islands, lives the cassowary, a running bird that grows five feet tall. It is a relative of the emu, the ostrich, and the rhea. Like them, it is unable to fly. But it is set sharply apart from them by the nakedness and other features of its head and neck. The head is protected by a crest of bone. In some species, the crest is flattened. In others, it rises like a helmet. The neck has red, yellow, or blue lobes of flesh, called wattles.

The body is clothed with drooping feathers, brown or black and hairlike. These are double, each with two shafts of equal length, as in the emu. The only noticeable parts of the wing are five stiff quills, used in fighting. The legs are thick and heavy, with powerful muscles in the thighs. Each foot has three toes. The long-nailed inner toe is a deadly weapon when directed by the bird's mighty kick.

The cassowary feeds mainly on fruit, bulbs, and insects. It nests on the ground in thickets. The eggs, from three to six in number, are green, with granulated surfaces. The male, usually smaller than the female, keeps the eggs warm. He stays on the nest for seven or eight weeks until the chicks are hatched. These are dull rusty brown, striped with black and white. The voices of the mature birds are strangely beastlike; they call by grunting, snorting, or bellowing.

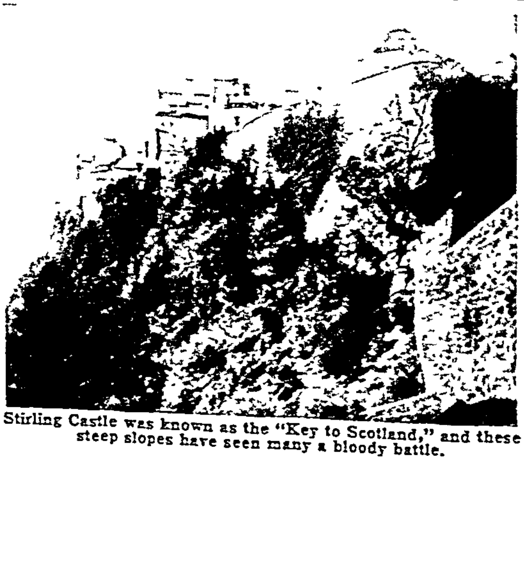
Scientific name of cassowary genus, *Casuarius.* With the emus, it forms the order *Casuariiformes.*

When MOATED TOWERS *Ruled* EUROPE'S LANDS

CASTLE. High above river and valley, on a rocky hilltop, the medieval castle looks far over the countryside. It is not the splendid palace of the novelists, but a strong fortress, built for war and defense.

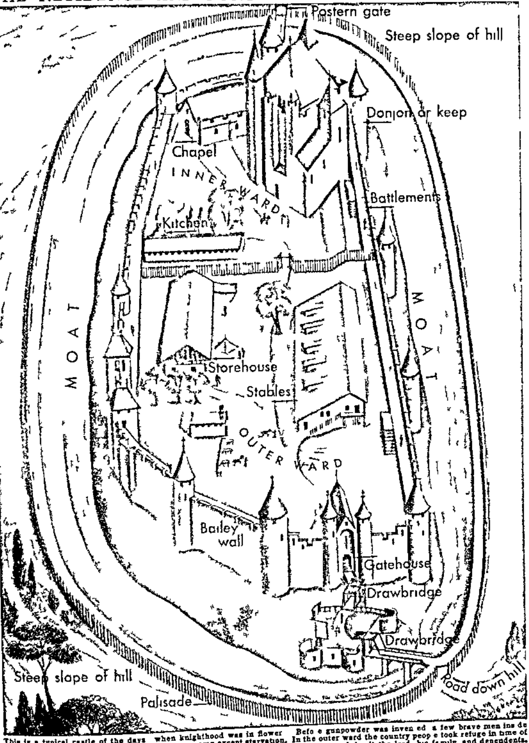
Around its walls is a deep ditch or moat. At the outer edge of the moat is a strong fence of heavy stakes (palisade) set in the ground. The outer castle wall (called "curtain" or "bailey" wall) is of solid stone, 5 or 6 feet thick and 16 to 20 feet high. Along the top of the wall is a parapet with open spaces. At intervals of a bowshot, rounded towers jut out from the wall's face, with loopholes from which archers may shoot. Between two towers is the entrance to the castle enclosure.

If an enemy succeeds in crossing the drawbridges over the moat, he must batter down a heavy wooden door between the two towers. Then he



Stirling Castle was known as the "Key to Scotland," and these steep slopes have seen many a bloody battle.

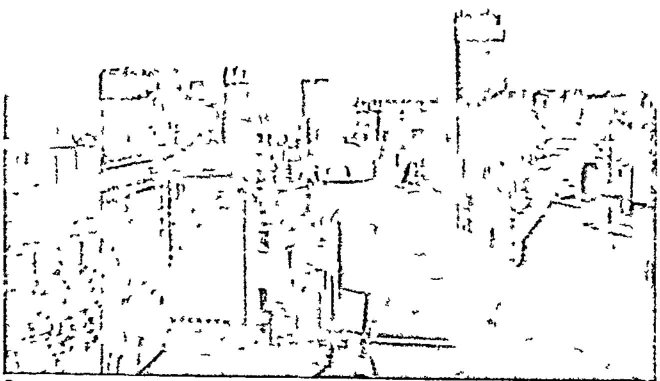
THE RESIDENCE AND FORTRESS OF A FEUDAL NOBLE



This is a typical castle of the days when knighthood was in flower Befo e gunpowder was inven ed a few brave men ins de such a castle could hold it against almost any enemy except starvation. In the outer ward the country peop e took refuge in time of war bringing provisions against a siege. In the donjon or keep in the inner ward dwelt the lord his family and dependents.

must pass an iron grating called the portcullis which has been dropped in the narrow passageway to bar his passage. The entrance is indeed well guarded. And even after the portcullis has been pried up and

A FAMOUS CASTLE IN WALES



Carnarvon Castle is one of the strongholds erected by Edward I after conquering Wales in 1283. Most of the old bailey wall and its 13 towers still stands, a picturesque sight to the visitor.

the last barrier in the castle gate passed, the enemy finds himself only in an open courtyard.

Within the enclosure made by the bailey wall are the stables where the lord of the castle keeps his horses; here perhaps is the great brick oven in which bread is baked for the lord and all his villagers; and here too the villagers themselves seek protection from the enemy. After this outer courtyard has been cleared of its defenders, the wall dividing the first and second courtyards must be carried before the second courtyard is reached.

Here again are a number of buildings. In one, provisions are stored to enable the dwellers in the castle to withstand a siege. Next to this is a curious jug-shaped building with a large chimney at the top and smaller ones in a circle round about. This is the kitchen in which the food is cooked for the whole household In addition there is a small church or chapel in this courtyard.

After this space has been cleared, the enemy at last arrives at the tall "keep" of the castle, or the "donjon" as the French call it. In the lower part of this building are "dungeons" for traitors and captured enemies. The walls of the keep are of stone and are eight to ten feet thick. From the loopholes in its sides peer skilled archers and crossbowmen ready to let fly their bolts and arrows at all below. A long siege will be necessary to starve out the defenders, for entrance can only be gained by a long causeway and drawbridge leading to the second story. If a siege is impractical, movable towers must be erected, battering rams used, stone-hurling machines (catapults and ballistae) employed, blazing arrows shot at the roof and windows, and tunnels dug to undermine the walls. Even when an entrance is gained, there will still be fierce fighting in the narrow passageways, in the dark halls, and on the winding stairways in the thick walls leading from one story to another. And even when all is lost, there still remain underground passages opening into the moat and a postern gate in the rear, through which the lord and his garrison may escape to the surrounding woods and so continue the battle another day.

Home Comforts in the Middle Ages

Where do the lord and his family live in time of peace? Sometimes they live in the upper stories of the huge donjon, where arms and supplies are kept Because of the thick walls and narrow windows, the rooms are usually cold and dark in spite of the great fire that roars in the fireplace at the end of the hall. Before the 12th century there were no chimneys. The smoke escaped after a time through an open window or a half-open door. More comfortable halls for residence purposes, apart from the donjon, were built at a later date, but they were still placed within the castle enclosure.

The furniture is scanty, though substantial. On the stone walls hang the weapons and embroidered tapestries Skins are placed underfoot for the sake of warmth. Chairs and benches, tables, chests, and wardrobes stand about the hall, and at mealtime the servants place a long trestle table down the middle of the room.

About this table all are seated according to rank. Before each is placed a knife, spoon, and a drinking cup, usually of wood or horn. Forks were unknown until the end of the 13th century, and separate plates or platters were rare. So the food is eaten from a common dish with the fingers. Before and after each meal pages bring basins of water and towels for washing the hands. There are no napkins; pieces of bread are used for cleansing the fingers during the meal, then thrown under the table to the dogs.

Dinner, served during the day, is announced by a trumpet. The meal is long and hearty. Often it may have 10 or 12 courses. Much of the time the meat is boiled, but roasts are especially enjoyed—wild bear, boar, swans, and game birds spitted over an open fire, and highly seasoned with pepper, cloves, and other spices. Even the wines are sometimes peppered and honeyed. On fast days fish and eels are relished.

After the meal is over, perhaps a wandering minstrel entertains the company with his songs of brave knights and fair ladies. Or the diners engage in games of chess, backgammon, and checkers. For outdoor amusements the nobles indulge in falconry, the tournament, and the chase.

The Ancestor of the Castle

The stone castle, or *château*, as the French call it, grew out of a much simpler fortification. In very early times the Frankish chiefs built wooden blockhouses on mounds of earth, around which they dug a broad ditch and built a palisade. This *castellum*,

or fortified camp was the ancestor of the castle The castles erected in Anglo-Saxon England and also those first erected by the Normans were similar to the Frankish structures Later the wooden tower was changed for one of masonry and the palisade was replaced by stone walls When the king in France or England gained control over the nobles the feudal castles either were destroyed or were taken over by him so that they might no longer menace the peace of the country

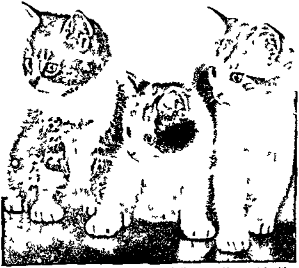
CASTOR AND POLLUX These famous demigods of Greek myth were twin sons of Zeus by a mortal mother Pollux was renowned as a skilled boxer and Castor was famed far and wide as a tamer of horses Sailors in storms prayed to them and they became patrons of travelers and of hospitality as well as of public games According to one story Zeus set them among the stars after their lives on earth and the constellation of Gemini (the twins) is named for them It is the third sign of the zodiac (*see* Zodiac)

CASTOR BEAN Oil extracted from the castor bean is valuable as a medicine Large amounts of the oil are used for many other purposes Great quantities are used in the manufacture of artificial leather Perfumes and dyes are made from it It is also used as a lubricant and in the manufacture of varnish rubber leather soap sticky flypaper linoleum and typewriter ink

The castor-oil plant is of tropical origin It is widely used in northern countries however for ornamental purposes It will grow readily if it is given plenty of sunshine and a deep rich soil With its beautiful large leaves it gives a tropical appearance to the garden

The castor plant is also grown commercially in the southern United States but the highest yield of oil is secured in the tropics There the plant grows to heights of 30 or 40 feet India and Brazil are the chief sources of supply The botanical name of the castor-oil plant is *Ricinus communis* (*See also* Fats and Oils)

CAT—*One of* MAN'S *Favorite* PETS



These three little kittens have tortoise-shell coats Alert and healthy they may some day grow up and become Grand Champions in a cat show

CAT During the California gold rush in 1849 thousands of mice and rats threatened the health and the food supplies of the miners One day a sailing ship the *SS Ohio* docked in San Francisco with several hundred cats aboard They had been bought in the East for ten cents apiece The miners eagerly bought the cats and paid as much as $50 in gold for a single cat In a few weeks the cats had driven almost all the rats and mice from the mining camps

Today in the United States approximately 27 million cats continue to help fight the half billion rats that destroy a billion dollars worth of food and property each year Without the work of these watch cats the destruction would be much greater

Many people keep cats as pets or breed them to exhibit in cat shows As pets household cats are second in popularity only to dogs (*see* Dogs Pets)

Cats Are Carnivores

The house cat is closely related to the tiger lion and others of the large family *Felidae* This family includes from 50 to 60 species The scientific name of the domestic cat is *Felis domesticus* (For other relatives of the domestic cat *see* Cat in the FACT INDEX)

All cats are *carnivores* that is flesh eaters They eat meat rather than roots or grain Most house cats will eat grass but they do not digest it

The cat s jaws are strong and equipped with 30 specialized teeth The pointed *canines* and the blade-like *carnassials* are used to cut and tear tough raw meat into chunks small enough to swallow The pieces of meat are swallowed without chewing

The cat s tongue is rough It is covered with horny projections These enable the cat to lap up

CURIOSITY—THE MARK OF ITS TRIBE

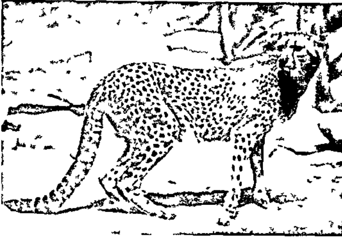
The old maxim "curiosity killed the cat" is matched by another, "every cat has nine lives." The natural inquisitiveness of cats often gets them into trouble, in spite of their alertness and sense of self-preservation. This young cat is typical of the common short-haired cats. It has gray "tiger" markings, but its brothers and sisters may be black, white, orange, or blue (Maltese), or mixtures of these colors. This type is usually sturdier and less high-strung than the long-haired breeds and gets along better with children.

its food They also help the cat wash itself Cats are spotlessly clean A hunter that lies in wait for its prey must have no odor to warn its victims

Close inspection will show how ideally nature suited the cat for its life as a hunter The back is long and flexible with powerful muscles The cat can make leaps seven feet in the air Its ability always to land on its feet is widely known The long tail helps to balance the cat as it jumps Perfect muscular control gives the cat a speed grace and delicacy of movement equaled by no other animal

All cats except the cheetah have retractable claws They can extend them or draw them back at will There are 18 claws five on each fore foot and four on each hind foot The cat s paw is almost as useful as a hand With the forepaws the cat washes its face and ears defends itself or plays with moving objects

CHEETAH AND OCELOT WILD RELATIVES OF THE HOUSE CAT



The cheetah is the only member of the cat family whose claws will not retract It is a very fast runner Sportsmen of India tame and train it to hunt with them

The ocelot is found in tropical America and the southern United States It is not much larger than a big house cat and is sometimes kept as a pet

Why the Cat's Eyes Shine in the Dark

A cat cannot see in absolute darkness but it needs much less light to distinguish objects than any other common animal The eyes round out greatly from the head These convex eyes collect light from a wide angle When a large amount of light is collected and reflected out again the eyes seem to glow

The cat s eyes can adjust themselves to varying degrees of light Under a bright light the pupils become narrow slits In the dark they widen to great circles almost as large as the entire eye

The cat s large erect ears detect sounds that escape the keenest human hearing They are also the sharpest of direction finders A cat will turn its head instantly toward the source of any hidden noise

The cat s long whiskers (vibrissae) are useful for a hunter in the dark They are delicate sense organs with sensitive nerves at each root They warn the cat of objects in its path Instinct also tells the cat the value of caution for its own safety A house cat will carefully inspect any new object brought into a room Even a hungry cat will cautiously inspect a dish of food before eating

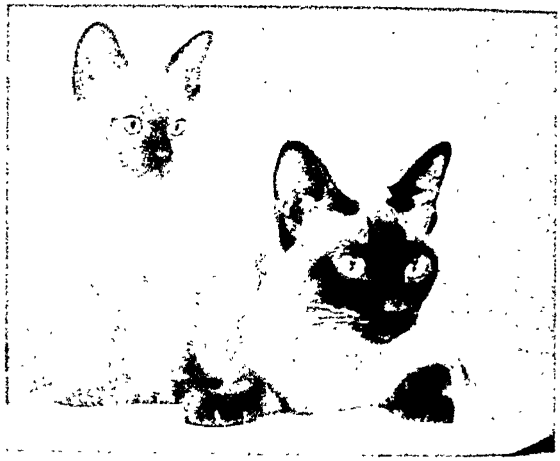
How the Cat Purrs

In the cat s voice box or larynx are two sets of vocal cords The lower are the true cords The cat uses them to produce mewing and howling sounds Above these are prominent membranes called the false cords When a cat is happy it relaxes the lower cords, so that they make no sound and lets the air play against the upper membranes This sets the membranes to vibrating and produces a soft fluttering sound which is called purring Like the house cat some wildcats such as the tiger lynx and puma also purr (see Tiger Lynx Puma)

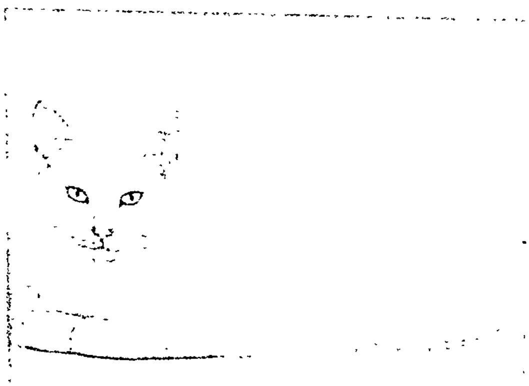
The American Cat Fancy

People who specialize in breeding cats and entering them in cat shows are called members of The American Cat Fancy or The Fancy Leading cat organizations in the United States include the American Cat Association the Cat Fanciers Association

LONG-HAIRED PERSIAN



SIAMESE



DOMESTIC SHORT HAIR

HOUSEHOLD PET (Domestic Short Hair)

the Cat Fanciers' Federation, and the United Cat Federation. Cat shows are held under rules prescribed by these organizations. At these shows, cats such as the ones shown on this and on the opposite page are exhibited and prizes are awarded for the best of breed in each class.

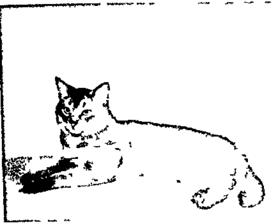
In most cat shows four classes are recognized. These are *Kitten*, for kittens four to eight months old; *Novice*, for cats which have not yet won a first prize; *Open*, for all cats except those having won championships; *Championship*, for all cats that have won first prize in the Novice, Open, or Championship classes. Kittens compete in kitten classes only. To earn points toward a Grand Championship a male or female champion must be judged the Best Champion and the Best Opposite Sex Champion of all colors in each show. Fifteen points are usually needed for a cat to be declared a Grand Champion. This means that a cat must be the Best Champion in a number of shows.

Origins of the Recognized Breeds

The long-haired Persian may be derived from the Pallas wildcat of Asia. The Angora, a long-haired cat from Angora, Turkey, no longer exists as a separate breed. It has been interbred with the Persian until the two breeds have become one.

The Domestic Short Hair is the most widely known of all the cats. It is the result of centuries of accidental crossbreeding and may vary widely in size, build, and appearance. In cat shows the Domestic Short Hair must meet the color requirements for the class in which it is entered. Domestic Short Hairs which do not meet the color requirements for their class are entered in shows as Household Pets.

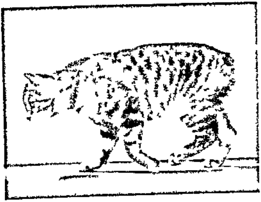
The Siamese cat was imported into the United



ABYSSINIAN

RUSSIAN BLUE

BURMESE



MANX

RECOGNIZED CAT BREEDS

American cat fanciers recognize the seven breeds of cats pictured on these pages Due to its color markings the Household Pet shown on the opposite page would not win as a Domestic Short Hair in a cat show A complete table of cat breeds and standards will be found in the Fact Index.

States about 1885 from England It had been imported into England from Siam (Thailand) about ten years earlier Its distinctive coloration—the dark points of the mask tail and legs—mark the Siamese as different in appearance from all other cats Siamese kittens are born white the points appearing several days later

The Burmese cat was probably originally a color variety of the Siamese It was imported into the United States from India in 1930

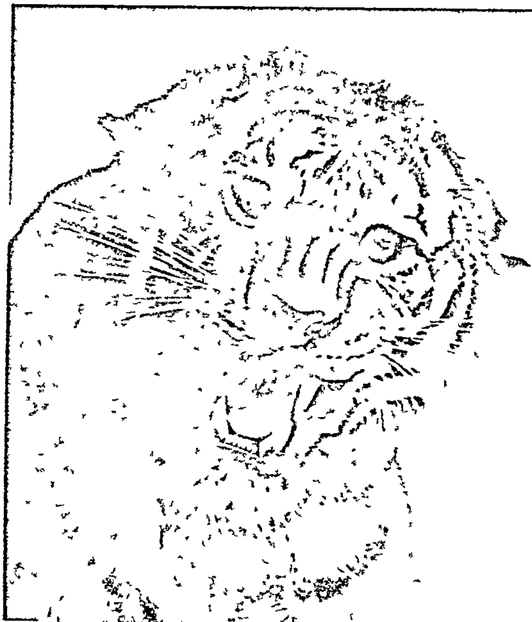
The Abyssinian is a close relative of the ancient sacred Egyptian cat It was introduced in America in 1936 Its distinctive ticked coat resembles that of the Belgian hare

The ancestors of the Manx cat came from the Isle of Man It is the only cat that has no tail Its short back and high hind legs give it a hopping gait

The Russian Blue is seen more in England than in the United States There it is called a Foreign Blue This is a breed quite distinctive from the blue domestic short hair commonly called a Maltese Its bright blue—almost lavender—fur is thick The coat is double like that of the seal (*see* Seal)

Maturity and Litters

A female cat matures at five to eight months the male at nine to ten months They may live to be 19 or 20 years of age The average is 14 years The female may begin to bear kittens at six months The gestation period of the house cat is generally from 55 to 56 days This period may vary depending upon



"BIG CATS" OF THE ZOO AND CIRCUS

The Siberian tiger (left) and the African lion (right) can be seen at the zoo or circus. Closely related to the house cat, they are the largest members of the cat family. Tigers differ from lions mainly in their coat coloring and in not having manes.

the breed. The gestation period of the various wildcats ranges from 55 to 69 days

Some wildcats are born with their eyes open, but the house cat is blind for several days. The number of young varies from two to seven, depending upon the species. Lions rarely have more than two or three young at a time (*see* Lion). The house cat averages four in a litter There can be two litters a year.

Care and Feeding of Cats

Kittens nurse from their mothers for about four weeks after birth. At the end of this time they can be fed a mixture of canned milk and water several times daily. Small amounts of canned cat food, finely ground raw meat, and milk may be given at least three times daily when the kittens' teeth are in. Kittens should not be taken from their mothers until they are eight weeks old.

At eight weeks, larger quantities of canned cat food, canned baby meat, and pieces of raw meat may be fed to them. Fish and fowl may also be added to the diet. From eight months on cats should be fed twice daily and fresh water should be available at all times. Usually a grown cat needs between three and five ounces of food for each meal

A healthy cat has a glossy coat and a good appetite. Any cat that is suspected of being sick should be taken to a veterinary. Illness moves swiftly in cats, and few illnesses can be treated by home remedies. Inoculations given by a veterinary after kittens reach the age of six weeks can prevent cat distemper, or feline enteritis. Rabies, which is rare in cats, can also be prevented by immunization

The Origin of Cats

The origin of the domestic cat is very doubtful. The first civilized peoples known to keep tame cats were the Egyptians They tamed cats 13 centuries before Christ. The Egyptian pet was probably the wild Caffre cat of North Africa, a small, pale yellow animal with black feet. The Egyptians regarded the cat with superstition and treated it as a member of the family. When a cat died, it was embalmed and buried like a human being, and the members of the family went into mourning. To kill a cat was a crime punishable by death. Mummified cats are found in ruins of ancient Egypt.

Forty or fifty million years before the Egyptians kept tame cats, the ancestor of the cat family first roamed the earth. This was in the Eocene epoch of geologic time. This small, long-bodied civetlike creature, called *Miacis*, was the ancestor of all carnivores By the Oligocene period two forms of cats appeared One was the ancestor of the saber-toothed tiger (*see* Saber-toothed Tiger). This beast became extinct more than 25,000 years ago. The other branch was the ancestor of the true cats of today. The Oligocene cats were already highly specialized, and they have changed very little since then. The habits and physical characteristics of the cat have been fixed for 20 to 30 million years. This may explain why house cats remain the most independent of pets, with many of the instincts and actions of their wild ancestors.

The early Christians associated cats with witches, and the devil was often depicted in the form of a black cat. Superstitions about cats survive among many peoples even in civilized countries today.

CATALPA There are eight or ten species of this flowering tree, two of which are found in the United States and the rest in eastern Asia The common catalpa is a native of the southern United States and is cultivated as an ornamental tree in most of our northern cities It is also grown extensively for fence posts and railroad ties as it is quick growing and is hardy and thrives in cultivation The clustered flowers of this species are white, slightly tinged with purple and violet in the throat the leaves are broad and vivid green in color, covering the tree with dense luxuriant foliage The flowers are followed by pods often a foot in length called Indian cigars by the children The tree seldom attains a height of more than 40 feet

The second American species is larger sometimes reaching a height of 120 feet It is a native of southern Illinois and neighboring states It too is planted as an ornamental shade tree

Catalpas belong to the trumpet creeper family *Bignoniaceae* The scientific name of the southern catalpa is *Catalpa bignonioides* The northern tree is *Catalpa speciosa*

CATBIRD The catbird is the mockingbird of the north Like its southern relative it mimics the other birds with many musical flourishes Its name comes from its success in imitating the plaintive mewing of a cat It is a bird of the thickets One usually sees it slipping quietly through the garden hedge or the heavy shrubs of roadside and field

The catbird is about nine inches long It is not showy with bright feathers but no bird of the garden is clothed with more distinction Both male and female are blue gray, with black cap and tail and a patch of chestnut under the tail (For picture in color, *see* Birds)

The large nest of twigs, dead leaves and rootlets may be hidden in the shrubbery about the very door of the house or in swampy thickets There are four to six eggs of deep bluish green color (for picture in color, *see* Egg) Catbirds eat insects and fruit, sometimes the garden berries but they prefer wild fruit if it is to be had They are common in the greater part of temperate North America They winter from the Southern states through Central America

Catbirds are related to mockingbirds and *thrashers* The three comprise the family *Mimidae* so named because of the birds skill in imitating other bird songs The scientific name is *Dumetella carolinensis*

IT SINGS FOR ITS SUPPER

With its brisk, inquisitive manner and its varied songs the catbird is a welcome visitor in any garden A piece of suet held in a combined rack and perch such as the one shown here will attract it and many other birds as well.

CATERPILLARS The *larvae or young of butterflies* and moths are called caterpillars, from the Latin word *catta pilosa* meaning "hairy cat" Most people recognize the hairy kinds, but there are many caterpillars with bare skins which are popularly called worms such as the cabbage worm

But a caterpillar is an insect in the making Its body consists of a head followed by 12 or 13 segments Like all insects, it has three pairs of permanent or true legs—one pair on each of the first three segments directly behind the head These true legs are usually hard, jointed, and tipped with tiny claws but in a few caterpillars they are not developed To support the rest of its long body, the caterpillar also has from two to five pairs of soft, thick *prolegs* These disappear when the caterpillar changes into a moth or butterfly

A caterpillar s eyes are tiny beads usually six in number on each side of the head just above the strong *upper jaws It breathes through nine porelike openings* (*tracheae*) on each side of its body

When a caterpillar hatches from the egg laid by the mother butterfly or moth it is usually very small But it grows rapidly and soon gets too large for its skin Thereupon the old skin splits, and the caterpillar wriggles out of it, clad in a soft new dress It *molts* thus four or five times Some caterpillars eat their old skins The hawk moth caterpillar, one of the largest, may grow four inches long the clothes moth caterpillar, one of the smallest seldom exceeds one-quarter of an inch Some caterpillars live only a few days before turning into butterflies or moths, but most of them last through the warm season A very few may live as long as four years before they change

The change caterpillars undergo is called *metamorphosis* (*see* Insects) The first step for many moth *caterpillars* is to build cocoons They spin them with threads of sticky fluid that flows from an opening in the lower lip and harden in the air (*see* Silk) Some of them form bags of silk that entirely enclose them Others roll up a leaf, fastening the edges with the silk Many of the hairy kinds pad the cocoons with their own hair Some caterpillars, including most of those in the butterfly group, do not build cocoons Many moth caterpillars take shelter simply by burrowing in the ground or under a stone or fallen leaf Butterfly caterpillars suspend themselves from leaves or twigs by their tails or spin a button of silk on a twig or leaf and hang from it by a silk girdle

But whether protected by a cocoon or not, the caterpillar now sheds its last skin, and in place of it grows a tough flexible shell or case. When this happens it has become a *pupa*. The moth pupa is usually dull brown and mummy-like. The butterfly pupa (sometimes called a chrysalis) is shiny and often brilliantly colored. Inside the pupal or chrysalid case, the rudimentary wings and other organs enlarge to make the moth or butterfly. The change may be completed in a few days or it may take several months.

To grow and prepare for this period of change, caterpillars eat enormously, causing widespread damage to trees, flowers, and crops (*see* Insects). The larva of the Polyphemus moth, a species of the American silk worm, has been estimated to eat 86,000 times its own weight in its 56 days as a caterpillar.

But caterpillars are the prey of many birds and insects, especially parasites. To avoid their attacks, caterpillars have various natural protections. Some are colored to blend with their surroundings. Others have startling gaudy dots or stripes to make them look fierce or very large. A few have scent glands to give off unpleasant smells, and a very few grow poisonous nettle-like hairs.

The larvae of sawflies (order *Hymenoptera*) are also sometimes called caterpillars, but a sawfly has only one pair of eyes (*See also* Butterflies and Moths).

SOME DAY IT WILL GROW WINGS

This caterpillar is the larva of the beautiful *Samia cecropia* moth. The photograph shows it about twice its natural size. The knobs (*tubercles*) on its greenish-blue body are red, yellow, and blue, and end in black bristles. This gaudy appearance frightens foes. Note the thick prolegs grasping the twig

CATFISH. In almost every stream and lake east of the Rockies live members of the catfish tribe. They also thrive in the Pacific states where they have been introduced. They range in size from the blue catfish that may grow six feet long and weigh 150 pounds down to the bullheads that boys catch in roadside ditches. Catfishes have smooth scaleless bodies, but their dorsal and pectoral fins bear poisonous spines that may inflict severe wounds. With the long barbels that reach out from the their broad jaws, they explore the muddy bottoms where they live. Almost anything they find they eat. Yet their flesh is firm and has a delicate flavor. They form the most valuable catch of the Mississippi River and its tributaries.

In the deep, swift channels of these rivers live the so-called "channel cats." The largest of these is the blue catfish, but the yellow catfish, or flat-

head catfish may reach 100 pounds. These giants are greatly outnumbered by the common channel catfish which weigh from 5 to 20 pounds.

The common bullheads, rarely more than a foot long, often prove to be the hardiest of our fishes. They manage to live when their ponds freeze almost solid and all their neighbors die. When ponds dry up they burrow down into mud and wait for the rains.

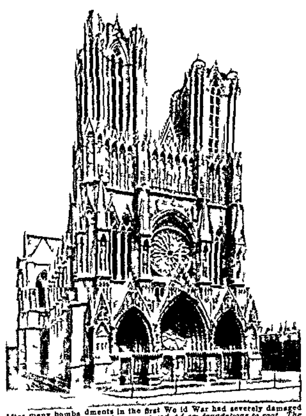
Including the various sea catfishes, more than 1,200 species are distributed over the world. Largest of all is the Danube's sheatfish, or wels (*Silurus glanis*). It may grow as long as 12 feet and weigh as much as 400 pounds. The scientific name of the blue catfish is *Ictalurus furcatus*; yellow catfish, *Pilodictis olivaris*; common channel catfish, *Ictalurus punctatus*; common bullhead, *Ameiurus nebulosus*.

CATHEDRAL. Early in the Middle Ages when Latin was still the language of religious and political life throughout western Europe, the church which contained the official "seat" or throne (*cathedra*) of the bishop was known as the *ecclesia cathedralis*, or "church of the seat." As time went on this term was shortened and today we call the church over which the bishop presides the cathedral.

In medieval days all western Europe was Roman Catholic, and so the entire community united in the effort to build a church which should not only glorify religion but which should also be a credit to the city. The bishop's church usually was the largest, finest, and most richly adorned church building in the diocese or bishop's district. This is not always true, however. The Church of St. Peter's at Rome is the most glorious church in Christendom, yet the seat of the pope—as bishop of Rome—is the older but less splendid basilica of St. John Lateran.

As a result of those efforts of medieval men we have today all over western Europe great gray stone cathedrals whose roofs and towers dominate the whole countryside. In the magnificent Gothic cathedrals built mostly between the 12th and the 15th centuries the tall pointed window openings are filled with pictures in stained glass, the rich and varied colors of which add to the splendor of the interior. Everywhere, within and without, the sculptor's art has scattered figures of men, animals, and plants. Artists and sculptors have vied with one another in representing the history of mankind and of Christianity. Scenes from the Bible, figures of the saints, and representations of the Virtues and Vices make up a kind of layman's Bible that appealed to the eye and was understood by all.

REIMS CATHEDRAL—A GOTHIC GEM



After many bombardments in the first World War had severely damaged this famous cathedral, workmen restored it from foundations to roof. The apse, flying buttresses, and façade were repaired. The windows were reconstructed with stained or colored glass. The rebuilt cathedral was consecrated in 1937. In the second World War it escaped damage.

Though these glorious Gothic churches are generally counted as the noblest expressions of man's achievement in the art of building, cathedrals built in other styles of architecture are no less supreme in their way. Byzantine, Romanesque, Renaissance—all have their special beauties. (*See* Architecture.)

It took hundreds of years to construct such cathedrals as Notre Dame in Paris, St. Mark's in Venice, Canterbury in England, and Cologne in Germany. A few, such as those at Amiens, Reims, Antwerp, and St. Paul's in London, have been seriously damaged in recent wars, but great advances have been made in the art of restoring these priceless monuments. Though the medieval cathedrals have never been equaled, there are many fine modern examples. In Liverpool is England's largest cathedral, a Gothic structure begun in the 20th century.

Notable cathedrals in America include the Roman Catholic cathedrals of St. Patrick in New York City, Notre Dame in Montreal, and the cathedral in Mexico City. The Cathedral of St. John the Divine in New York City and the National Cathedral of St. Peter and St. Paul in Washington, D. C., are Protestant Episcopal. (*See also* Cathedral in the FACT INDEX at the end of this volume.)

CATHER, WILLA (1875–1947). In such classic American novels as 'O Pioneers!' Willa Cather wrote of people she had known as a girl in Nebraska. Her friends were both native Americans and European immigrants and their children. She showed how these pioneers adapted themselves to the rugged prairie life and how they helped build western America. For her depictions of this valiant spirit, Willa Cather won wide acclaim as a novelist.

WILLA CATHER

Willa Cather won fame for her novels of frontier life.

Willa Cather was born Dec. 7, 1875, in Winchester, Va. Her family had been Virginians for four generations. When Willa was eight, her father bought a ranch near Red Cloud, Neb. The child was excited by the change from a settled, eastern community to a semifrontier life. Often she would ride to a neighbor's house and listen to the old women tell of their childhoods in Sweden or Bohemia.

There were no schools near the ranch so she studied at home. A neighbor taught her Latin, and Willa read English classics aloud to her grandmother. The pretty red-haired girl loved the outdoors. When Willa was in her teens the family moved to town. She attended Red Cloud High School and the University of Nebraska. After graduation in 1895 she worked on a Pittsburgh newspaper for six years, then taught high school for a time. On vacations she traveled to Europe and the American Southwest.

Meanwhile she contributed stories to *McClure's Magazine*. She accepted a post on the magazine, and in 1908 she became managing editor. But editing left her little time for creative writing, and in 1912 she resigned to devote full time to her own stories.

Her first novel was unsuccessful, but when she turned to frontier themes she won a wide audience. 'O Pioneers!' (1913) was followed by 'Song of the Lark' (1915) and 'My Antonia' (1918). 'One of Ours' won the Pulitzer prize in 1923. Also popular were 'Death Comes for the Archbishop' (1927), a study of Catholic missionaries in New Mexico, and 'Shadows on the Rock' (1931), a story of early Quebec.

Willa Cather never married. She lived quietly in New York City or traveled in Europe, avoiding public appearances whenever possible. She remained loyal to childhood friends and visited them often. She died in New York City on April 24, 1947.

CATHERINE THE GREAT (1729–1796). One of the most famous queens in history was Catherine II, empress of Russia. She was a beautiful woman and an efficient ruler, but her immoral conduct made her notorious throughout Europe.

Catherine was the eldest child of Christian August, prince of a Prussian state called Anhalt-Zerbst. She was born at Stettin (now Szczecin, Poland) on May 2, 1729. She was christened Sophie Auguste Friedrike; her girlhood nickname was Fike.

When Fike was 15, she and her mother were invited to Russia by Empress Elizabeth, daughter of Peter the Great. The empress was looking for a wife for her 16-year-old nephew, the Grand Duke Peter, heir to the Russian throne. Fike was intelligent and gave promise of her later beauty. She was approved.

On June 28, 1744, Fike was received into the Orthodox church and renamed Catherine. The next day she became engaged to Peter, a small, delicate youth who still played with dolls and lead soldiers. They were married on Aug. 21, 1745. The marriage was unhappy. Peter remained a boy in body and mind. Catherine's first child, later Czar Paul I, was not born until 1754, nine years after the wedding. Four more children were born in later years.

The Empress Elizabeth died in January 1762 and Peter became Czar Peter III. His weak-minded ways soon made him unpopular. He offended church dignitaries and preferred the companionship of Germans to Russians. But Catherine was well liked. She had accepted Russian customs as her own. In July 1762 the army placed Peter under arrest and declared Catherine empress. Several days later Peter died after a scuffle with his guards.

As grand duchess and as empress Catherine read and studied much. Often she rose before the servants and began work. She started to write a history of Russia, made a digest of Blackstone's 'Commentaries', and wrote several plays. Her rule was greatly influenced by such Frenchmen as Voltaire and Diderot. She admired French manners and insisted that her court adopt them.

CATHERINE THE GREAT

Catherine II of Russia was noted for her beauty and intelligence.

Catherine reigned for 34 years. She increased the number of nobles and their privileges, installed a new code of laws, and extended the boundaries of her empire. She helped divide Poland among Russia, Austria, and Prussia (*see* Poland). Her important agents and ministers became her favorites. One of them, Prince George Potemkin, commanded the army in the Turkish wars. Under him, Russia won the Crimean Peninsula and access to the Black Sea.

Frightened by the French Revolution's threat to all monarchies, Catherine attempted to ally the rest of Europe against France. But she was only partially successful. As she grew old, her beauty faded and she became fat. She died Nov. 17, 1796.

A Guernsey cow and bull pose for a photographer at a rail fence Guernsey cows give yellow colored milk that is rich in butterfat

The Most USEFUL *of All* DOMESTIC ANIMALS

CATTLE Because men get meat leather milk butter cheese glue medicines hair for binding plasters and many other products from cattle they are the most valuable of all domestic animals Cattle called *oxen* are also used as draft animals Cattle for meat milk and pulling burdens are important in almost every country of the world In some parts of Africa a man s wealth is counted in terms of the cattle he owns In the United States more than 85 million cattle provide work and wealth for ranchers farmers dairy and leather workers and others

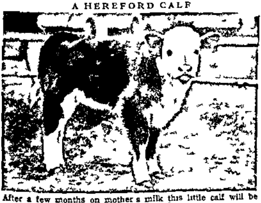
In ages long past cattle roamed wild over most of the world Men hunted them for their meat and hides Some cattle are still wild America s musk ox and bison are wild cattle Men probably domesticated cattle somewhere in southwestern Asia during the early part of the New Stone Age (*see* Civilization Man)

What Cattle Are

The word cattle once meant all kinds of domestic animals The word comes from the Latin word *capitale* which means wealth or property Through French and English usage and adaptation the word cattle is used now only when referring to *bovines*

A bovine is a cud chewing ruminant with a four chambered stomach hollow horns and an even number of toes on its hoofs (*see* Ruminants) Bovines belong to the family *Bovidae* and are of the genus *Bos* European and most American cattle belong to the species *Bos taurus* The humped cattle of Africa India China and southeastern Asia called *zebus* belong to the species *Bos indicus* Other humped forms are the *gaur* and the *gayal* of southern India some of which have been domesticated and the numerous and well-domesticated *banteng* (also spelled *bantin banting* or *tsaine*) of India Burma Malaya and the Indonesian islands Still others are the *bison* forms of Europe and America and the *yak* of Tibet in Asia The bison (in America often incorrectly called buffalo) has not been domesticated but the yak has The true *buffalo* of southeastern Europe and Asia has been domesticated also It is widely used for milk and meat production and as a draft animal

A HEREFORD CALF



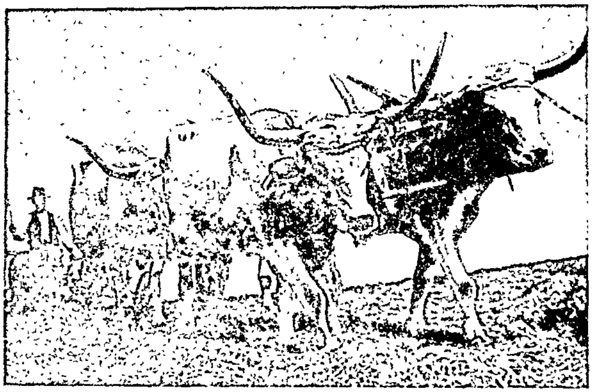
After a few months on mother s milk this little calf will be fattened on grain hay and silage

One variety of the European *Bos taurus* was the now extinct *urus* (*Bos primigenius*) at one time popularly called giant ox and aurochs (This was not the European bison which was also called aurochs) The urus was very large its withers (highest point above the shoulders) often measuring as high as seven feet *Another European variety a much smaller animal* was the *Celtic ox* (*Bos longifrons*) Most European and American breeds of today descended from one or the other of these two varieties and some are descended from both

Mature cattle have 32 teeth but they do not have teeth in the front of the upper jaw Thus a bovine grasps rooted grass in its mouth and tears the blades free by a sideways movement of its head

A *bull* is a male and a *cow* is a female bovine A *calf* is the young of either sex A *bull calf* is a young male bovine a *heifer calf* is a young female Between one and two years a bovine is called a *yearling* A mother cow is called a *dam* A *steer* is a male bovine

WORKING AND WILD CATTLE



These four Bavarian cattle (left) pull a plow. Cattle, used as work animals, are called oxen. Oxen sometimes pulled the prairie schooners of the pioneers who settled the American West.

The gaur bull (right) is fierce and much larger than most domestic cattle. Gaur cows are only a little bigger than Jerseys. The gaur, or Indian bison, roam wild only in southern India.

which before it reaches maturity is made incapable of mating; a *spayed heifer* is a female bovine similarly operated on. Desexualized cattle are gentle and tractable; they also gain weight faster and produce finer-grained meat. Most male oxen are steers.

Some cattle do not grow horns; they are called *polled* cattle. Purebred cattle eligible for registration with the various breed associations must have descended from arbitrarily selected *foundation stock*. Cattle that have the characteristics of a specific breed but are not purebreds are called *grades*. Cattle having poor breed characteristics are called *scrubs*. It is a common practice to mate grade cows with purebred bulls to improve, or *upgrade*, the progeny.

The life span of cattle would be about 20 years but nearly all are sent to slaughter much earlier. Heifers are first mated when 15 to 20 months old. The gestation period of bovines is about 282 days.

Selective Breeding

Today's domestic cattle of Africa, Asia, and the Indonesian islands are very much like the cattle that lived in those areas 2,000 years ago. In Europe and America, however, cattlemen have produced new and superior types of cattle. They did this through *selective breeding*.

LEADING CATTLE-PRODUCING COUNTRIES

Country	Number of Head*
India	205,000,000†
United States	82,535,000
Brazil	45,134,000
Argentina	35,695,000
China	22,450,000
France	14,691,000
Germany	14,166,000
Australia	13,881,000
Union of South Africa	12,677,000
Mexico	12,459,000
United Kingdom	9,624,000
Canada	9,537,000

*A four-year average †Includes buffaloes

Robert Bakewell, an English farmer who lived between 1725 and 1795, is credited with first applying the rules of selective breeding to cattle. He established such principles as "like begets like," "plan an ideal type," and "breed the best to the best." Later he began to use *inbreeding* (mating related cattle), saying "inbreeding produces refinement and early maturity." His method was to pick a bull of good beef quality and mate it to a cow of similar good qualities. By carrying this plan of mating through several generations of cattle, he developed fine beef-type animals that usually had young of the same characteristics. His methods, qualified by later scientific discoveries in heredity, are used by cattle breeders today (*see also* Biology; Heredity).

Cattle that display qualities unlike those of their parents are called *sports*, or *mutants*. German scientists, by mating varieties that showed qualities of long-ago ancestors, have been able to produce animals similar to the ancient urus.

Cattle in America

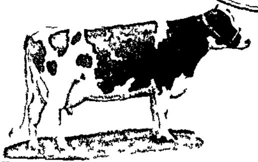
Because no native American *Bovidae* has been domesticated, America had to import its domestic cattle. Most of America's cattle came from Europe and so belong to the *Bos taurus* species. Since 1900, however, the species *Bos indicus*, or zebu, has been imported. (Information on the imported zebus will be found under the subhead "Beef Breeds" on a later page of this article.)

Norsemen first brought European cattle to America about the year 1000. Their colony disappeared, however, and their cattle disappeared with it. Columbus next brought European cattle to Hispaniola (Haiti) on his second voyage (1493). In 1519 or 1520 Cortez took Spanish cattle to what is now Mexico. Because of the great length of their horns, these cattle were called *Longhorns*.

The Longhorns were big, wiry, and muscular. They proved hardy foragers of the open range. They not only survived wolf and mountain-lion attacks, but thrived in semiarid country. Spanish priests drove the Longhorns to the missions they established in

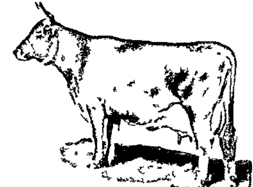
SOME WELL-KNOWN MILK CATTLE BREEDS

A Holstein Friesian bull is heavy in front and ean and muscu lar in the rear It is colored b ack and wh te Da ry breed bulls are fierce-tempered and dangerous They will attack people

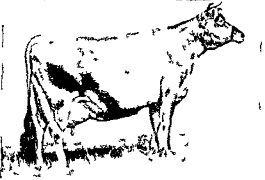


Holste n Fr esian cows g ve more milk than any of the other milk breed cows but the m lk has a smal er percentage of but terfat Note the milk vein *that runs forward from the udder*

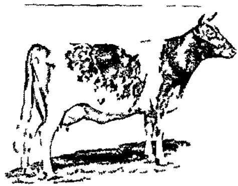
Ayrshire cows are also large milk producers Note how large the udder or milk bag of th s one is Ayrshires are white wi h red markings The Ayrshire breed was developed in Scotland



Brown Sw ss ca tle came originally from Swi zerland They are co ored in vary ng shades of brown They are large m lk producers Brown Swiss herds can be found n many parts of America.



Jerseys are small and fawn-colored This one has wh te markings Because of its rich m lk and small s ze captains of sailing ships liked to carry a Jersey along for milk and cream.



Guernseys are red and wh te Like the Jersey breed the Guernsey was also deve oped on an island in the English Channel It too is small and produces milk that is rich in butterfat

Texas New Mexico and California Longhorns became the dominant western type and were so identified with Texas that they sometimes were called Texas Longhorns Longhorns prospered in South America too With them Braz l an l Argentina have become leading exporters of beef (*see* Argentina Brazil)

The Jamestown colony in Virginia got its first Engl sh cattle in 1611 As the English Dutch and French settled the eastern coast from Canada to Florida they brought the r cattle with them

At that time cattle furnished some m lk but usu ally only during spring summer and fall They

RELATION OF CATTLE NUMBERS TO HUMAN POPULATION IN THE UNITED STATES

Year	Humans	All Cattle	Other than Milk Cows*	Milk Cows
1870....	39,818,449	31,082,000	21,410,000	9,672,000
1880 ...	50,155,783	43,347,000	31,593,000	11,754,000
1890....	62,947,714	60,014,000	45,014,000	15,000,000
1900 . .	75,994,575	59,739,000	43,195,000	16,544,000
1910 ...	91,972,266	58,993,000	39,543,000	19,450,000
1920 . .	105,710,620	70,400,000	48,945,000	21,455,000
1930 ...	122,775,046	61,003,000	37,971,000	23,032,000
1940....	131,669,275	68,309,000	43,369,000	24,940,000
1950....	150,697,361	77,963,000	54,110,000	23,853,000

*Figures include heifers and bulls that belong to dairy herds

The above table, taken from United States census figures, shows that dairy-cattle and beef-cattle breeders have been increasingly efficient since 1890. In that year the cattle population was about 95 per cent of the human population; in 1950, to meet dairy and beef needs, the country required a cattle population of only about 52 per cent of the human population.

usually dried up during the winter because of lack of proper foods, but the European cattle were superior in meat qualities to the Longhorns.

Texas pioneers from the United States raised the Longhorns. Their herds grew very large, and soon after Texas joined the Union (1845) they began driving cattle eastward to New Orleans and northeastward into Missouri, Illinois, and Iowa. Still later they were driven to feed on the grasses of the northern Great Plains. Until the 1870's and the arrival of railroads in the West, the drives continued. The whole great ranching country of the West prospered with Longhorn cattle. There the techniques of herding and branding were developed. Sometimes so many cattle were ready for the market that the beef could not all be sold. The rancher still prospered from the sale of cattle hides and tallow. (*See also* Far West.)

As the eastern seaboard became more heavily populated, pioneers pressed over the Appalachians into Tennessee, Kentucky, and Ohio. They took their eastern cattle with them. After the Civil War and with the building of railroads the westward tide of pioneers increased. Eventually the Longhorns and the eastern cattle met. The superiority of the eastern cattle was recognized by the ranchers, but at first they did not believe these eastern cattle could withstand the hard life of foraging on the range. It was found that they could, however, and in crossing the Longhorns with Eastern types the Longhorn gradually disappeared. Only a few head of them remain in North America. (For a picture of a Longhorn, *see* the article on Cattle Ranching.)

Dairy Cattle

The dairy farmer earns his principal income from the sale of milk and milk products. Other sources of income are the calves sold as veal and the old cows and bulls sold as beef. Most veal comes from the slaughter of dairy calves not needed as replacements. Few dairy cattle are permitted to die of old age.

Dairying can be combined with almost any type of agriculture. More than 76 per cent of the United States farms and ranches keep at least one milk cow, and for this reason dairy cattle are the most widely distributed of all domestic animals.

About 11 per cent of the farms within the United States are *commercial dairy farms*—that is, milk is their chief product. Since milk spoils quickly, commercial dairy farms that sell *whole milk* lie close to population centers. Such a milk producing area is called a milkshed. Dairy farms within the milkshed must operate under rules of sanitation imposed by the health boards of the cities and states they supply. These rules include periodic tests of the dairy cattle for disease and inspections of milking rooms and the handling and cooling of the milk.

Commercial dairy farmers beyond the milkshed gain their principal income from the sale of cream, which is the light part of whole milk and contains the butterfat. Cream is less bulky to ship and commands a higher price than milk. Commercial dairy farms still more distant from the population centers sell their milk to factories that manufacture it into butter; cheese; ice cream; condensed milk (part of water content evaporated); casein; lactose; lactic acid; dried whey; canned whole milk; and powdered whole milk, skimmed milk, and cream. These farmers engage in dairying because their farm-grown products are more profitable when converted to milk through feeding to dairy cows than when sold direct from the farm. Excess milk produced within the milkshed and cream areas is called *surplus;* surplus milk is also manufactured into milk products.

The great dairy belt of the United States extends southward from New England to central Maryland, and westward across the Mississippi to eastern Iowa

DAIRY CATTLE

Breed	Place of Origin	Average Weight		Average per Cow Milk Production of Registered Herds		One-Year Record Milk Production (lbs.)
		Cow	Bull	Whole Milk (lbs.)	Butterfat (%)	
Ayrshire	British Isles	1,150	1,700	9,016	4.08	31,156
Brown Swiss	Switzerland	1,400	1,850	9,478	3.96	29,569
Guernsey	British Isles	1,100	1,600	8,208	4.80	26,672
Holstein-Friesian	Netherlands	1,500	2,000	11,243	3.48	42,805
Jersey	British Isles	1,000	1,500	7,037	5.36	23,677

and Minnesota Of the states within the dairy belt Wisconsin has the largest number of dairy cows more than 3½ million Other large milk *producing states* are Minnesota New York Iowa Illinois Ohio Michigan Pennsylvania and Indiana Over all the United States there are about 26 million dairy cows heifers and bulls (*See also* Agriculture Butter Cheese Dairying Farm Life Ice Cream Milk)

Dairy Breeds

Dairy cows are relatively lean quite angular and have large udders Dairy breeds have been developed to the conformation (shape and structure) of an *ideal dairy type* Purebred dairy cattle are registered with the appropriate breed association Many purebred bulls are used to upgrade herds of grade cows Grade cattle are spoken of as belonging to the breed they are like

Usually the cows that conform closely to the ideal dairy type are good milk producers but this is not always so Dairy breeding now depends more on milk records than on conformation Mating a bull that has had daughters of high milk production to cows that are high producers and that are themselves the daughters of high producing dams is the usual method of producing better milk cattle

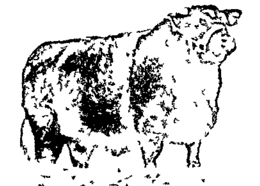
COMPOSITION OF THE MILK OF DAIRY BREEDS

Breed	Total Solids %	Average Fat %	Protein %
Ayrshire	13 00	4 00	3 50
Brown Swiss	13 00	4 00	3 50
Guernsey	14 50	4 96	3 75
Holstein	12 30	3 42	3 30
Jersey	14 80	5 36	3 80

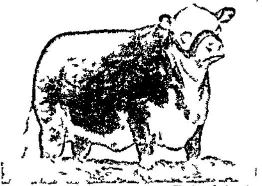
(For pictures in color of these breeds *see* Milk.)

The *Ayrshire* breed originated in Ayrshire Scotland It is red of any shade and white with the colors clearly defined Some black and brindle markings are acceptable in purebred registration but they are not desired Its horns incline upward are of medium length and taper toward the tips A mature cow weighs about 1 150 pounds Ayrshires were first brought to the United States from Scotland in 1822 later some of the importations came from Canada Herd development did not begin until the 1880s A record one year milk production for one Ayrshire cow was 31 156

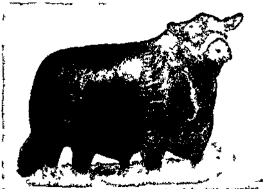
SOME OF THE WELL KNOWN BEEF BREEDS



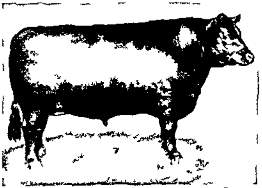
Note how squarely built this Shorthorn steer is Both top and bottom lines are almost horizontal This is the desired shape for beef breeds This steer is rusty red with white markings



Herefords are red with white markings The Hereford is also called Whiteface because its face is white More Hereford cattle are raised in America than any of the other beef breeds

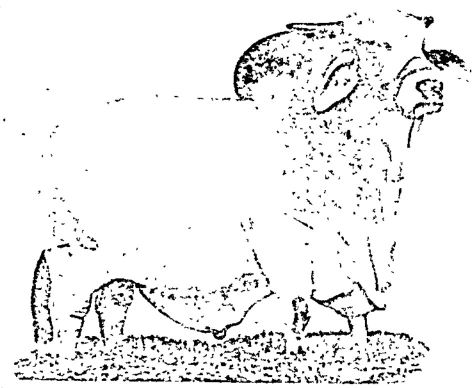


The Aberdeen Angus breed was developed in two counties of Scotland. It is black and always polled (does not grow horns) Beef breeders like to show their cattle standing in straw

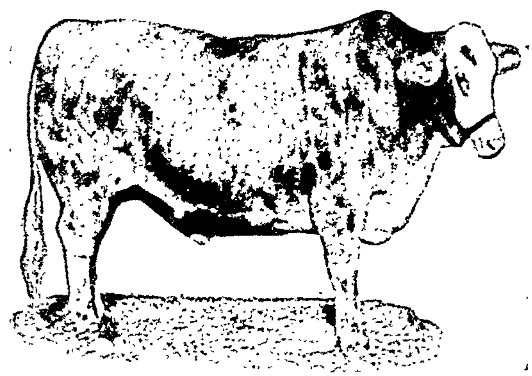


In 1904 this Aberdeen Angus steer was a prize winner Compare it with the steer at the left Because of the demand for smaller beef cuts breeders have developed cattle with smaller bones

THE BRAHMAN AND A BRAFORD



A zebu brought to this country from India is called a Brahman. Its heritage equips it to endure heat and to resist disease and insects. The neck hump is mostly cartilage and fat.



In the United States Brahmans are crossed with other breeds to secure heat-, disease-, and insect-resistant animals. This fine cross between a Brahman and a Hereford is called a Braford.

pounds. The Ayrshire Breeders' Association, organized in 1875, has headquarters at Brandon, Vt.

The *Brown Swiss* breed originated in the valleys and on the mountain slopes of Switzerland. As a breed type it probably developed many centuries ago. The breed colors are varying shades of brown. The nose and tongue are black, and a patch of white spreads backward from the muzzle. The horns rise slightly and taper toward black tips. At maturity a Brown Swiss cow weighs about 1,500 pounds. Brown Swiss cattle were first brought to the United States in 1870. A record one-year Brown Swiss milk production for one cow was 29,569 pounds. The Brown Swiss Breeders' Association, organized in 1880, has headquarters at Beloit, Wis.

The *Guernsey* breed originated from cattle native to Brittany and Normandy, France. It was developed on the British Isle of Guernsey, near the French coast. Monks brought cattle of the two kinds to the island about the year 1000. Crossbreeding of the best of the two breeds resulted in the Guernsey. In 1824 the islanders, because they feared deterioration of their breed, forbade the importation of any other cattle to the island except for slaughter.

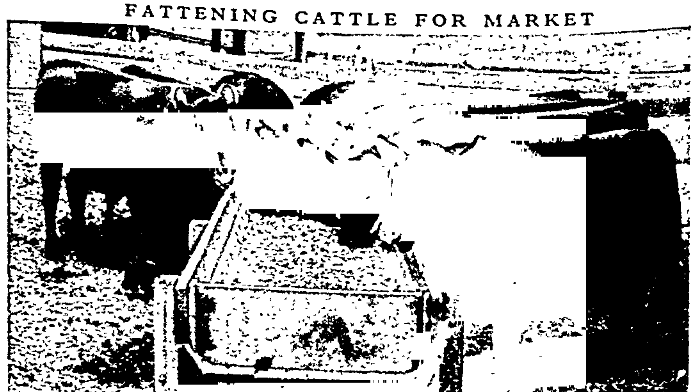
The Guernseys first brought to the United States in 1831 were a cow and a bull. By 1877 the development of Guernsey herds resulted in the founding of the American Guernsey Cattle Club. Its headquarters are at Petersborough, N. H.

The average Guernsey cow weighs about 1,100 pounds. A record one-year milk production for one Guernsey cow was 26,672 pounds. The Guernsey milk is a rich yellow color and has an average butterfat content of 4.96 per cent. One or more Guernsey cows are sometimes kept with Holstein herds to increase butterfat content and improve the color of the milk. Guernsey beef, because its fat has a yellow color and its muscles are flat, is not popular as meat.

The *Holstein-Friesians* (usually called simply Holsteins) are the most numerous dairy cows in the United States. Their black and white markings are clearly defined. A mature cow weighs about 1,500 pounds. Its horns incline forward, curve a little inward, and taper at the tips. They are the largest milk producers of all breeds, but the butterfat percentage of total milk is less than that of other breeds. A one-year record production for a Holstein cow was 42,805 pounds.

The Holsteins originated in the Netherlands. Although some were probably brought with the first Dutch settlers of New York (about 1621), the breed did not become popular until after 1852, when a large number of Holsteins were brought to this country. Several Holstein associations were formed by breeders. In 1885 these joined to form the Holstein-Friesian Association of America. It maintains headquarters at Brattleboro, Vt.

FATTENING CATTLE FOR MARKET



Fattening cattle for market is called "finishing." Feed troughs like this one are kept filled with roughage (hay and silage) and grain, and the cattle are permitted to feed whenever they like. The steers above are of the Red Poll breed.

Although the *Jersey* breed is the smallest of the dairy cattle it produces the largest percentage of butterfat an average of 5 36 per cent Dairy farmers with Holstein herds often keep one or more Jerseys to build up the butterfat content of their milk The mature Jersey cow weighs about 1 000 pounds Its color is a shade of fawn and it may or may not have white markings Its horns small at the base incline forward have an inward curving tendency and taper toward the tips Because of its small size the Jersey eats somewhat less than cows of other breeds consequently it is less costly to raise and maintain A one-year record milk production for one cow was 23 677 pounds Jersey beef brings somewhat lower prices because its fat has a yellowish color

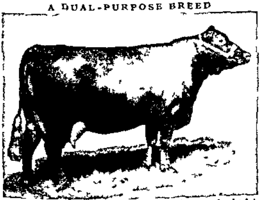
The Jersey is one of the oldest of the dairy breeds It originated on the Isle of Jersey a British island near the coast of France and the Isle of Guernsey There are said to be more Jersey type cattle throughout the world than any other dairy breed Because of its small size it was the preferred milk cow for voyages in the old sailing ships As early as 1789 the Isle of Jersey forbade the importation of any cattle except for immediate slaughter Registered Jerseys were first brought to the United States in the 1850 s The American Jersey Cattle Club founded in 1868 has headquarters at Columbus Ohio

Among the other dairy breeds in the United States are the *Dutch Belted* the *French Canadian* and the *Kerry* The Dutch Belted has a broad white stripe about the middle of its otherwise black body Both the French Canadian and the Kerry are small cattle the cows weighing about 900 pounds but their milk is produced at a small cost for feed These breeds are mostly in eastern Canada and the northeastern part of the United States

Beef Type Cattle

The beef type bovine is squarely built The body is short low-set broad and deep The legs are short and well fleshed and both top and bottom lines are almost horizontal The beef type bovine quickly converts the food it eats to muscle and fat

A DUAL-PURPOSE BREED



Dual purpose cattle produce good milkers that can also be fattened into high-quality beef carcasses The Red Poll cow is particularly popular on general purpose farms of the Midwest.

Beef cattle are produced in almost every section of the United States and its possessions including the Gulf coastal area from Florida to the Mexican border and the Hawaiian Islands The 13 largest beef producing states (not necessarily in the order of production) are Texas Iowa Nebraska Kansas Illinois Missouri California Oklahoma Minnesota Wisconsin Ohio Michigan and New York

In the western regions cattle graze over a vast area some of it leased government pasture and forests Older cattle marketed from this area are usually fattened on grass They are not top grades of beef and are slaughtered as soon as marketed The younger cattle are usually sold to feedlots near the slaughtering centers of Kansas City Mo Omaha Neb Sioux City Iowa St Louis Mo St Paul Minn Fort Worth Tex Denver Colo and St Joseph Mo At the feedlots they are fattened or *finished* on roughage (hay and silage) and grains cottonseed cake or sugar beet pulp A considerable number of other cattle are finished on roughage and pasture grass The corn belt finishing operations produce the finest quality of beef Here most of the highly desired baby beef is finished

At birth a beef type calf weighs about 80 pounds At six months a well fed animal weighs about 450 pounds and at 12 months about 850 pounds If well fed until 24 months old the animal will weigh about 1 300 pounds Thus in the first 12 months the weight of a good beef animal increases almost 800 pounds but in the second 12 months (although the intake of food is much larger) it increases only about 450 pounds Young beef is therefore less costly to produce than older beef

Baby beef cattle sold between 8 and 18 months old range from 600 to 1 100 pounds The age and the degree of finish control whether the cattle will be marketed as *prime choice good medium common* or one of the lesser grades

Better quality beef animals weigh more than animals of lower grades of the same age There is about 100 pounds difference between animals graded common and good and there is another difference of more than 70 pounds from the good to the choice and prime grades Weight alone however is not the determining factor on quality, quality depends on the texture and shape of the meat cuts

Higher grade cattle (choice or prime) yield a higher percentage of their live weight as salable meat (*carcass*) than do lower grades High-quality beef animals yield carcasses that are 80 per cent of live weight The poorest quality animals yield carcasses that are only 40 per cent of live weight The average beef carcass of all grades yields 53 4 per cent of live weight (*see also* Meat Packing)

Beef Breeds

The *Aberdeen Angus* (often called simply Angus) is an all black polled breed It originated from native wild cattle in northern Scotland The breed was developed in the shires (counties) of Aberdeen and Angus probably in the middle 1700 s Angus cattle

were first brought to the United States in 1873. Some were crossed with another British breed. The majority of the resulting calves were black and almost all were polled. These crossbreeds fattened smoothly and quickly. A purebred Angus herd was started with new importations in 1878. The American Aberdeen Angus Breeders' Association, formed in 1884, has headquarters at Chicago, Ill.

The *Shorthorn* breed ranges in color from solid red and red with white markings to roan and white. It was developed principally in the English counties of Durham and York, and in the past has also been known as Durham. A branch of the breed is polled, and the name for these is *Polled Shorthorns*. Purebred Shorthorns were first brought to the United States in 1783. Starting in 1846 several Shorthorn breeders' associations were formed. In 1935 these joined to form the American Shorthorn Breeders' Association, which has headquarters at Chicago, Ill.

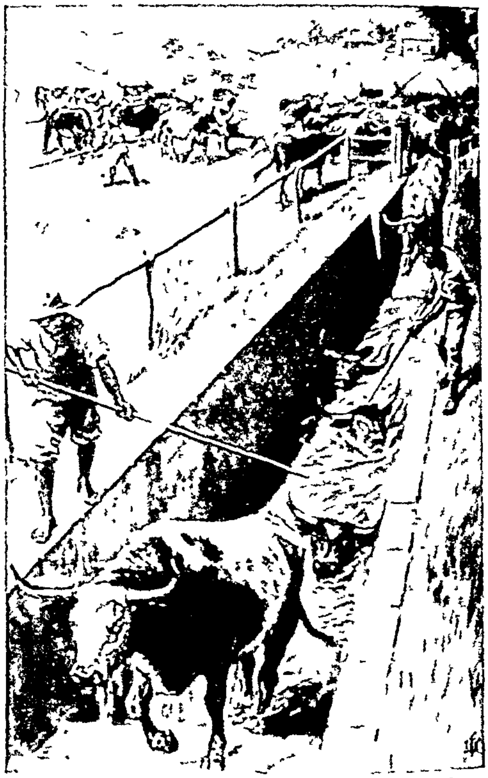
The *Hereford* breed originated in Herefordshire, England, from cattle common in the area and spotted cattle brought from the Netherlands about the middle of the 1700's. There are more Hereford cattle in the United States than any of the other beef types. Herefords are red with a white face. They are often called "whitefaces." A strip of white extends from the neck rearward along the back, and the underparts are white. Henry Clay imported some Herefords as early as 1817. Another herd was established in 1840. The Hereford's fast conversion of food to meat made it quickly popular.

In 1882 early Hereford breeders' associations united to form the American Hereford Association with headquarters at Kansas City, Mo. The development of Polled Herefords brought about the formation of the American Polled Hereford Association, which also has its headquarters at Kansas City. Many purebred Polled Herefords are registered with both associations.

The *Brahman* (zebu) breed is native to India. The Brahmans endure heat and resist disease and insect attacks better than other breeds. The Brahmans are large, with a hump of cartilage and fat rising above neck and withers. Most are some shade of gray, others are red. In India they are found in a variety of solid and broken colors. The Brahman's qualities have made them popular in the hot and humid Gulf Coast area from Florida to Texas. Brahmans are mated with other beef breeds to produce hybrids also able to endure heat and resist disease. Brahmans were first brought to the United States in 1849, but heavy importations were not made until the early 1900's.

At the King Ranch in Texas, Brahman-Shorthorn crosses have been developed into a new breed called *Santa Gertrudis*. The new breed carries three-eighths Brahman and five-eighths Shorthorn blood. Other crosses are the *Braford* (Brahman-Hereford) and the well-established *Brangus* (Brahman-Angus). The American Brahman Breeders' Association, organized in 1924, has headquarters at Houston, Tex. The *cattalo*, a hybrid cross between the bison and a domestic bovine, has not been commercially successful.

ONE WAY TO PREVENT CATTLE DISEASES



Farmers of Natal, Union of South Africa, drive cattle into a dipping vat. The chemical solution kills parasites.

Another beef breed is the all black *Galloway*. Not now popular in the United States, its ability to withstand cold has made it acceptable in the Rocky Mountain area and in Alaska.

The Dual-Purpose Breeds

The conformation of the dual-purpose breeds is more like the beef than the dairy breeds. They require more costly feeding to finish off as beef than the beef breeds, and as milk producers they also require more dairy feed than the dairy breeds. The advantage in keeping them lies in that they bring higher prices than the dairy breeds as beef and that their milk production usually more than pays for their keep. The dual-purpose herds of the United States are mostly centered in the north central states, on farms that are neither specifically beef finishers nor commercial dairy producers. Until sold as beef most of the dual-purpose cows provide the milk and cream needs of the farm.

The three most important dual-purpose breeds in the United States are the *Milking Shorthorn* (now considered exclusively a dairy breed by many), the *Devon*, and the *Red Poll*. All come from England. The Devon was first popular as a work ox, and it is still considered the most responsive and docile of the work oxen. America's few Devon herds are mostly in the Eastern states. The Milking Shorthorns are the most numerous. The breed is most popular in the Midwest.

The Red Poll developed *during the first half of the* 1800s from native cattle in the English counties of Norfolk and Suffolk In 1874 English and American breeders joined in establishing a herd book At that time the United States had only four Red Polls eligible for registration Importations and breeding have greatly increased the number The Red Poll Cattle Club of America organized about 1900 has headquarters at Lincoln Neb The Red Poll has a flesh-colored nose usually a red and white tail switch and is otherwise red except for minor white markings on the underparts

Diseases of Cattle

Tuberculosis in cattle a bacterial disease related to human tuberculosis is dangerous to man It is spread in infected milk and milk products but the organism is killed by pasteurization Infected cattle are identified by the tuberculin test of Robert Koch (*see* Koch) In the United States infected cattle are destroyed and their barns thoroughly disinfected before new cattle are brought in

Brucellosis or Bang s disease when contracted by man is called undulant fever Sick animals are segregated and treated Calves can be immunized by vaccination At about two weeks after birth calves are also vaccinated against colds and pneumonia and at about two months against blackleg and anthrax (*See* Pasteur Vaccination)

Foot-and mouth disease may attack any cloven hoofed animal It causes running sores in the mouth and between the toes Infected cattle that do not die require two or three years to recover their full flow of milk or finished weight The disease has been eliminated in the United States and Canada by stringent livestock admission laws and by the slaughter of sick animals Rinderpest is a contagious virus disease of the digestive tract It is rare in the United States Foot-and mouth disease and rinderpest can be forestalled by vaccination

Texas fever is caused by a microscopic parasite related to the one-celled animals that cause malaria It destroys the blood cells (*see* Mosquito) The parasite is carried by ticks The female tick in sucking blood from an infected animal receives the parasite and passes it through its eggs, which are laid on the ground to hatch The hatched ticks attach themselves to cattle and in biting transmit the parasite Texas fever was carried north in the great cattle drives Cattle of the north were infected when they crossed infested ground

The discovery of the Texas fever parasite was made by Theobald Smith and F L Kilborne in 1889 They found that the ticks die within three or four months if they cannot attach themselves to an animal By keeping cattle from infested fields for four or more months the ticks have been almost eliminated

A disease control measure used by cattlemen in many parts of the world is the *dipping vat* This is a sunken tank filled with a chemical solution An inclined runway leads from one end of the tank Cattle driven into the dipping vat drop into it so that they are completely immersed in the solution Then they swim to the inclined runway and climb out Dipping vats are used to kill ticks and other pests including the itch mite that causes *scabies*

Poisonous Plants

Cattle are poisoned and some killed by eating poisonous plants Some of the plants poisonous to cattle are larkspur lupines spotted hemlock Jimson weed Indian hemp western sneezeweed some of the milkweeds corn cockle ball nettle bittersweet black locust castor bean and white snakeroot

Perhaps the most dangerous of the poisonous plants are the white and purple locos growing widely over the Great Plains Cattle that eat these plants suffer loco disease (from the Spanish meaning crazy) An animal suffering loco disease is unable to co-ordinate its muscles has disturbed vision and becomes nervous Death usually follows loco poisoning

Still another poisoning occurs when cattle eat plants growing from seleniferous soils In themselves the plants are not poisonous but they take up the poisoning metal selenium from the soil

It is noteworthy that none of the poisonous plants are particularly liked by cattle If plenty of other feed is available cattle will not eat them Some of the Western states have tried to eradicate loco weeds and other poisonous plants but without total success The cattleman can best protect his animals from plant poisoning by seeing to it that the cattle have an ample supply of herbage in their grazing areas (*See also* Poisonous Plants Selenium)

When CATTLE *Ruled the* WESTERN PLAINS

CATTLE RANCHING The days when cattle ranches extended over hundreds of thousands of unfenced acres are some of the most colorful in American history Thousands of stories for books movies radio and television have been woven around the cowboy He wore woolly chaps carried a six shooter and bitterly fought rustlers as well as land waterhole and sheep wars

The ancestors of the millions of cattle that grazed the range were descendants of cattle brought to Mexico by the Spanish conquistadors Because their horns swept widely they were called Longhorns They thrived on the scant plants and occasional waterholes of northern Mexico and Texas American emigrants to Texas took the big wiry animals for their own At times there were so many that the meat of the slaughtered could not all be sold the ranchers still made profits from the sale of hides and tallow

It was on Mexican and Texan ranches long before Americans arrived in the Southwest that the system of raising cattle on the open range developed Here too the methods of the cow country and the equipment of the cowboy were devised From the Spanish-speaking *vaqueros* or herders the Americans

in Texas were to learn the business, and they in turn were to pass it on to the cattlemen of the northern Great Plains on the last American frontier.

The article on the Far West tells how the American pioneers from the eastern and central states blazed trails westward from the Mississippi River across those Great Plains and the mountains beyond them, how they "opened up" the Indian country, and paved the way for the settlement of what had been called the "Great American Desert." But close upon the heels of the explorers and trail-makers, ahead of the farmer-settler, came the frontier cattlemen with their small herds of scrub stock, gradually moving westward as the farms closed in around them and cut off the free pasture lands.

The Cattlemen Move West

By the time of the Civil War most of the land east of the Mississippi had been settled upon by southern planters or northern farmers. In Ohio and Kentucky and Illinois, the farmers were raising improved stock and driving excellent beef cattle to the markets. The western edge of the border settlements was to be found in Iowa, eastern Nebraska, and Kansas. Here the pioneer farmer had stopped, but the frontier stock grower had moved on. Herds of heavy work cattle and beef animals of eastern breed were familiar sights around remote mining settlements, army posts, and stage stations of the Far West even before the Union Pacific Railroad was completed in 1869. The Mormons had taken good dairy and beef stock with them into the Great Salt Lake basin. Many immigrant trains to California and Oregon had been accompanied by small herds of Devons and Shorthorns. And before that, when the Cherokee Indians had been forcibly moved in 1838 from Georgia to what is now Oklahoma, they had brought along numbers of cattle, descended from stock acquired from the whites on the Atlantic seaboard.

Yet, if all the cattle then living east of the Mississippi had been driven out into the Great Plains, they would hardly have made an impression on the vast prairies and foothills drained by the Missouri and Arkansas rivers and their numerous tributaries—the region comprising today the states of Montana, North and South Dakota, Wyoming, Nebraska, eastern Colorado, western Kansas, and Oklahoma.

Gen. Luther P. Bradley, reporting to the War Department in 1868, after an extended tour of army posts in this territory, wrote this estimate and prophecy: "I believe that all the flocks and herds in the world could find ample pasturage on these unoccupied plains and the mountain slopes beyond; and the time is not far distant when the largest flocks and herds in the world will be found here, where the grass grows and ripens untouched from year to year."

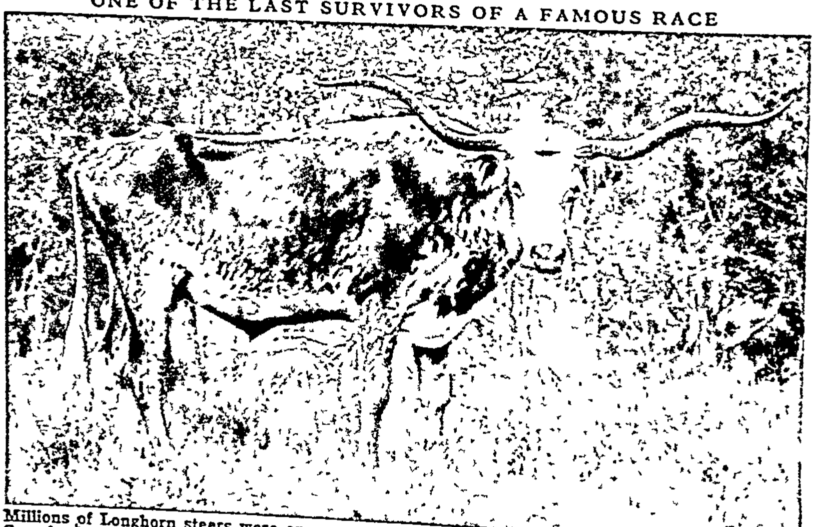
Texas Cattle Move North

If the cattle from the east were neither numerous enough nor sufficiently accustomed to hardy independence to take advantage of this great opportunity, their half-wild cousins south of the Red River in Texas were ready for it. Already too crowded for the scanty grazing and infrequent watering places of their native *llanos* (plains), the longhorns had little chance to gain the flesh that would make them worth more than the mere price of a hide. For such as could be called "beef," the Texans by 1867 had found an outlet by driving them north to Abilene, Kan., then the western terminal of the Kansas Pacific Railroad. From there they were shipped to packing plants at Kansas City and Chicago.

But it was not until the later 70's that the longhorns began moving northward in large numbers. Some of the large Texas ranches set up their own headquarters on the new ranges, drove their young steers up over the trails, turned them loose for a year or two to fatten, and then shipped them east to market. Others sold beef stock to newly established northern ranchmen, who might agree to drive the cattle up themselves or who might insist on their delivery at some appointed place in Colorado, Nebraska, or the territories of Dakota, Wyoming, or Montana.

With the cattle came also the lore of the cow camp and the range, which the Texans had learned from Mexico and which they in turn passed on to the

ONE OF THE LAST SURVIVORS OF A FAMOUS RACE



Millions of Longhorn steers were once scattered over the American plains from Mexico City to Canada. But, as this forlorn beast seems to realize, the breed was fit only for the hard old days of the open range. Today, the few that are left are kept as curiosities.

SKILFUL WORK WITH A ROPE AT A CALF ROUND-UP

The rider has just thrown a small loop so nicely timed that it has snared the running calf's two hind legs. This art of "heeling" calves with so few misses that the roper keeps up with the "wrestlers" at the branding fires is an accomplishment that even in the old days of the master cow punchers was a mark of distinction. The loop is rarely whirled in such work; it is thrown with a turn of the wrist, disturbing the other animals as little as possible.

ranchmen and riders of the northern plains. This lore became a vivid and essential part of frontier life and has left its indelible stamp on American tradition.

Branding Cattle on the Range

With thousands of cattle belonging to many different ranches wandering at will over unfenced ranges, branding was a necessity. Each owner selected a letter or sign of some sort, and this brand was stamped with a hot iron on every animal belonging to him. Where the brand was seared in, the hair never grew again. A cattleman's brand was his most cherished possession; no coat of arms was ever more jealously guarded by ancient noble. He burned it into the wood of his wagons, traced it on the leather of his saddle, had it inlaid in gold or silver into the stock of his rifle or the grip of his six-shooter, and printed it at the head of his stationery. In later days it was a matter of official record, and no one else in the same district was permitted to use the same mark. To alter a brand on horse or cow so that the animal might appear to belong to someone else was the gravest crime on the range.

Each year new born calves had, of course, to be branded before they left their mothers, otherwise none could tell to whom they belonged. This was the reason for the spring, or calf, round up. The ranchmen of each district cooperated in this task. With their cow boys they met at some appointed place. A round up boss, or foreman, was selected whose duty it was to supervise the work and maintain discipline. Then the horsemen in twos or threes moved out over the range with orders to drive in the cattle to the round up ground. Sometimes this took several days, and it was always an exciting business. The cattle were wild, hard to manage, and often found in rough country where riding was difficult. As each batch of cattle came in, they were sometimes driven into corrals, or great circles of wooden fence. But there were few corrals on the range, so usually the cattle were guarded, or "held," as the cowboys called it. The riders appointed for that job circled the herd and drove back any that attempted to break away.

Then the job of branding began. Expert ropers rode into the herd and "heeled" the calves, that is, caught them with a loop around their hind legs, and dragged them out of the herd to the fires where the branding irons were heating. A pair of "wrestlers" seized each calf and threw it on its side, turning loose the rope, while the roper called out the brand he had noted on the calf's mother. This mark was stamped on; certain ear marks might be cut which would help later to distinguish the animal when crowded too close in a herd for the brand to be visible, and then the calf was allowed to find its way back to its mother.

It was a lively scene, as those who saw it were not likely to forget. The calves kicked and bawled, sweating men struggled with some unusually large young animal while their companions offered mocking advice, branders ran from the fire with irons that must be used quickly before they cooled, clouds of dust from the milling herd and the galloping riders mingled

with the blue smoke of smoldering cottonwood logs. "Tenderfeet," to whom the spectacle at first might have seemed unfeeling and cruel, would have been surprised to see how rapidly the calves recovered from their experience and began nibbling grass or nursing their mothers. Neither the disposition of the cowboys nor the interests of the cattle owners encouraged brutality in any phase of range work.

The Question of "Mavericks"

Inevitably, some animals evaded the spring round-up and calves grew up and separated from their mothers without a brand to tell who owned them. These were the "mavericks." The name dates back to the days immediately following the Civil War. Texans returning from the front to their neglected herds found scattered over the ranges thousands of full-grown unbranded cattle. By custom they were the property of anyone who could catch and put his mark on them. In the ensuing rush with rope and iron, a man named John Maverick surpassed all others, so much so that Texans jokingly said that the absence of a brand was a sure sign of a Maverick animal.

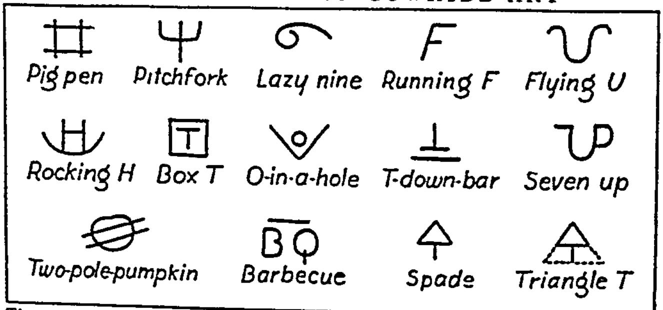
The rule that allowed the first-comer to brand a maverick enabled many a man to accumulate a herd who started, as the saying went, "with nothing but a branding iron." No one blamed such men; the custom was old, the range was large, and a few cattle more or less made small difference to the big ranchmen. But in later years when many small settlers moved into the "cow country," scattering over the range and particularly taking up homesteads near springs and water-holes where the cattle came to drink, most of the mavericks fell to them. The big ranchers protested; laws and regulations followed restricting the branding of mavericks to the period of general round-ups, when all unbranded animals were divided among the cattle owners of each region in proportion to the number of their cows.

This attempted reform at the expense of an old custom aroused rebellion. Many disregarded it, and among these were men who, suddenly finding themselves marked as lawbreakers for a practise previously sanctioned, grew resentful and became outlaws in earnest. They "made" mavericks by driving calves away from their mothers; they altered brands; they killed the steers of the big cattle companies, buried the skins, and sold the beef; in a word, they became out and out "rustlers." Yet such was the sympathy for them on the part of the majority of other small settlers, so vague the dividing line between the rebel and the criminal, that court convictions were hard to obtain. The cattle "barons," as the owners of the large ranches came to be called, organized private protective associations, hired their own detectives and, in some cases, employed notorious "gun-fighters" to guard their interests. Out of all this arose some of the violent "range wars," such as the famous Johnson County War in Wyoming, where United States cavalry had to intervene to put an end to pitched battles between the opposing "armies" of the cattle barons and the settlers.

Life on the Cattle Trail

But such episodes were in the main exceptional. The ordinary life of the range provided in itself excitement enough to satisfy the most adventurous. Particularly was this true of the northward drives of the Texas cattle. Herds of longhorns, numbering from 2,000 to 5,000 head, were selected or "put up," as it was called. Every animal would, of course, have on its flank the brand of the owner, and in a single herd there would be as many different brands as there were owners.

SOME SAMPLES OF COWHIDE ART



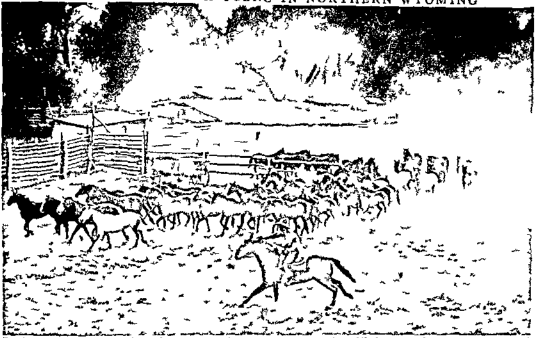
The imagination of western cowmen found picturesque expression in the design and names of their brands. The ones shown here are genuine registered brands, while the names given are those actually used by the men of the range. How ingenious rustlers altered the brands of cattle they stole is well illustrated by the last two figures in the lower right-hand corner.

But before they set out on their long dusty journey northward, another brand was added, called a "road brand," which would show that they all belonged to that particular herd which was going up the trail

The first to leave the ranch or the round-up ground was the "chuck-wagon." This was a stoutly built canvas-topped wagon drawn by four horses, driven by the cook of the outfit. In the wagon were the food supplies, the cooking equipment, and the bedding. With the chuck-wagon went the "remuda," or "saddle band," made up of the extra horses that would be required, for each cowboy on the trail was assigned a string of four or more cow ponies. The "horse wrangler" was in charge of these horses—just the job for a young apprentice in the "cow business" Many a boy got his first taste of independence as wrangler for his father's outfit, and many a tenderfoot from the East broke into the admired company of "regular cow hands" in the same way.

Behind the chuck-wagon and the saddle band came the herd itself. Abreast of the leaders of the herd, on the "point," as it was called, rode the foreman or boss of the outfit, and across from him, on the other "point." his most experienced cowboy, the "top hand," or "segundo." As they turned in their saddles and looked back down the long line of cattle, they could see through the dust two other riders, one on

A TYPICAL RANCH SCENE IN NORTHERN WYOMING



Ranch work began before sunrise each day when the horse wrangler drove in the saddle horses so the punchers could catch the mounts they needed Here we see the wrangler turning the bunch out to pasture again. Note how stables and corrals are built of native logs

each side of the herd These were the swings Behind them still further back were two more the flanks Then bringing up the very rear were the remaining men the drags These last had the most disagreeable job of all They usually rode in a great cloud of dust raised by the thousands of hoofs ahead In the drag were all the lazy slow and lame cattle It was tiresome business hazing these beasts forward so that they would not be separated from the rest

When noon came the foreman on the point could see ahead of him the chuck wagon already on the spot decided upon before the start The cattle were stopped and allowed to graze The cook had the noon meal ready and his shout of Come and get it! was a welcome sound to the hungry cow boys

After a rest of an hour or two the remuda was driven in usually to a rope corral stretched from the wagon wheel the riders roped and saddled fresh horses and the march was resumed Toward sundown the herd was brought upon the bed ground selected for the night The day s travel of 10 or 15 miles was over As the herd came up it was allowed to spread out drink at a near by stream or water hole and then feed After the men had eaten the first of those who had been selected to guard the herd through the night rode off to their posts leaving the campfire where jokes and laughter and song killed lonesome Soon beds were unrolled and tired riders slept under the stars Beyond in the darkness the herd rested quietly Around them rode the lonely night guards working in four shifts of two hours each

Often things were not so peaceful These wild longhorns were easily stampeded Sometimes it was a storm sometimes a wild animal sometimes hostile Indians

OH BURY ME NOT ON THE LONE PRAIREE!

Many of the old cowboy songs are classics of American folk lore They were invariably sung in plaintive falsetto This flashlight photograph was made in a genuine cow camp and shows the rear of the grub wagon.

AT THE END OF A ROUND-UP—COW PUNCHERS IN WORKING CLOTHES

The typical costume of the range rider is well illustrated in this photograph—high-heeled boots, spurs, and "chaps," the latter ornamented with silver-headed rivets and "conchos" (Spanish for "shells"). Observe the snug fit of the rider at the left in his saddle and the straight hang of his stirrups in contrast to the so-called English saddle "seat" of Eastern riders. The man at the right is handing over a "tally book" on which he has made a record of the day's work. The record includes the number of cattle "cut out" in the course of the round-up, their ages, sex, and brands.

and sometimes just an unusual noise or smell, that started the stampede. Then there was trouble and danger for all. Thundering along wildly through the night, a herd might run for miles before quieting down. The whole outfit must turn out to help the night herders to head them off and round them up again. This was dangerous business, and called for nerve and reckless riding. If a cow pony stumbled, there was sure death for horse and rider beneath the thudding hoofs of the maddened, night-blinded herd.

Finally, the long trail was behind, and the herd was turned loose on its new range, or loaded into cattle cars at some railway shipping point.

As time went on, and cattle from Texas were driven north in ever-increasing numbers, regular trails were used. There was the Chisholm Trail from San Antonio to Abilene, the Western Trail from central Texas to Ogallala, Neb., and still further west the Pecos Trail.

The Romantic Figure of the Cowboy

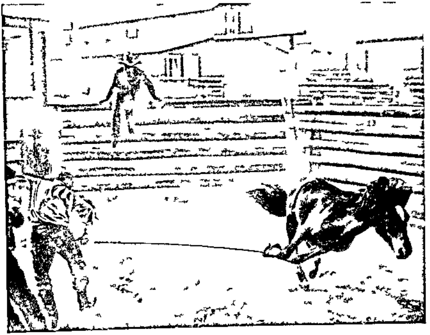
The little towns at the end of these trails became famous throughout the West. There were Abilene and Fort Dodge in Kansas, Sidney and Ogallala in Nebraska, Pine Bluffs and Cheyenne in Wyoming, and away north, on the Montana ranges, Glendive and Miles City. In these cow-towns one could see the vivid and picturesque life of America's last frontier—Texas cowboys celebrating after the long drive; eastern stock buyers; cattle "kings," who counted their wealth in thousands of head; gamblers, freighters, buffalo hunters, and soldiers from near-by army posts.

In all this interesting life of the western plains, the cowboy or "cow puncher," as he preferred to call himself, stood out as the most important figure. The man himself, the clothes he wore, and the horse he rode were all outgrowths of life on the range. The long days in the open, riding alone with the cattle, gave him self-reliance. The danger of stampeding cattle, of "bad" horses, of hostile Indians, of bitter winter blizzards, demanded nerve and courage. And finally, the whole business of driving, roping, and handling cattle required expert horsemanship.

The Making of a Cow-Horse

The most important possession of the cowboy, the necessary partner in every detail of his work, was

A HARD SCHOOL FOR HORSE AND MAN



his horse He was a tough wiry animal descended perhaps from the horses brought into the southwest by the Spaniards He was born out on the range and ran wild until he was two or three years old Then he was run down and driven in to the ranch corral There his education began He was first taught never to run on a rope by the effective method of roping and snubbing him to a post so that every time he tried to escape he would throw himself Then he was taught to lead that is to follow at the pull of rope or rein instead of holding back

Next he was saddled and allowed to wear himself out in the hopeless effort to throw the saddle off And finally after a few days of such schooling a bitless bridle called a hackamore (from the Spanish *jáquima*) was slipped on his head a blindfold passed over his eyes and the bronco buster got into the saddle As soon as the blindfold was removed the bronco would usually rear pitch sunfish swap ends and try out other varieties of bucking in his effort to get rid of his rider To hold his job the bronco buster had to be able to stay with the majority of his mounts on this first ride for a horse that started out with the impress on that it was easy to throw a man might turn into an outlaw useless for serious work

Above a wild colt is learning the folly of running on a rope At the right the rider is trying at the risk of his neck to prove to the horse the uselessness even of throwing himself to throw a man As the horse falls back the rider will try to tumble clear so he can climb in the saddle again while the horse is getting up

Presently when the half broken horse learned to take a bit without hurting his mouth he was turned over to the cowboys for the finishing touches that would make him a good cow horse He learned to obey neck reining that is to turn at the pressure of the rein on his neck instead of at the pull on the bit as eastern horses did He grew alert in following the twists and turns of running cattle and in bracing himself for the shock when his rider roped a steer

The Cowboy s Equipment

The cowboy s saddle was a heavy affair sometimes weighing 40 pounds or more A broad cinch or girth of woven cord went under the horse s belly Sometimes particularly when heavy roping had to be done this was supplemented by a second or flank cinch In front of the wide deep seat was a horn around which the cowboy took turns or dallies with his rope when pulling down a steer The rider sat straight-legged his feet in the heavy ox bow stirrups Sometimes these stirrups were protected by heavy leather hoods or *tapaderas*

"STRETCHING" A YOUNG BULL FOR HIS OWN GOOD

When an animal is too big to be "wrestled" down and held still by hand, two ropers catch and stretch it out as shown in this photograph. It is here that a good "rope horse" shows his intelligence, for he must stand still and maintain a steady pull on the rope to prevent the animal from struggling. The man straddling the bull is vaccinating it against the disease called blackleg, which particularly afflicts young cattle.

The range rider's rope or "lariat" (from the Spanish *la reata*) was 20 to 40 feet of braided rawhide, horsehair, or plain hemp. Looped through a loose running knot, this rope was thrown over the heads of the cattle, or cast under their feet. A skilful cow-hand, mounted on a pony that knew his business, could bring a steer down on the dead run.

The cowboy's dress was suited to his job. He wore a woolen or cotton shirt and heavy woolen trousers. Around his neck a big handkerchief was tied to protect him from the sun, or to be pulled up around his mouth and nose when dust was thick. Pulled on over his trousers were his "chaps" (pronounced *shaps*, from the Spanish *chaparejos*). These were leggings of heavy leather for summer wear and of fur for the cold northern winters. They protected his legs from brush and cactus and frost. A high-crowned, broad-brimmed felt hat, the "sombrero," shielded him from sun and rain. His soft-legged boots had high heels set far under the instep to hold his ankle clear of the heavy stirrup and to prevent his foot from slipping through it. Long-shanked spurs with large rowels jingled as he rode. When occasion demanded, he carried a .45 caliber "six-shooter" in an open holster strapped to his hip by a cartridge belt.

The Cattle Boom—Then Trouble

Ten years after the first longhorns trailed north, the range cattle business was booming and the idea that the Great American Desert could not be used by white men had been proved false. The Indians had been pushed back into reservations; the great buffalo herds had been wiped out by hunters, and from Texas to Canada herds of cattle grazed, watched and handled by a comparatively small number of men.

There were at first big profits in the business. Great grazing grounds were open to everybody and all that was needed was a ranch house, corrals, cowboys, and—cattle. Every year thousands of longhorns came up over the trails and thousands of fattened cattle were sold at good prices. Long trains loaded with steers for market bumped along over the tracks of the Santa Fe, the Union Pacific, and the Northern Pacific. Easteners and foreigners with money to invest, hurried westward hoping to make their fortunes.

All this extension of the cattle business brought with it great dangers By 1885 the plains everywhere were becoming crowded with herds and cattlemen were fighting among themselves for the range Those who owned land along the streams and around the water-holes were able to keep others off their range, for cattle must get to water When this method of controlling the range was not possible, fencing was tried, and soon lines of barbed-wire appeared

Sheep from California and Oregon were driven in on the crowded ranges and bitter wars between sheepmen and cattlemen resulted In the late 80's, the pioneer farmer began moving out on the range Hardier varieties of wheat, dry-farming methods, and irrigation made agriculture possible where a few years before no one would have tried to settle In Kansas and Nebraska farmers' fences blocked the old trails and grazing grounds became grain fields

The End of the Trail

Neither the cattlemen themselves in their associations, nor the state, nor the Federal government, were able to solve the ensuing problems The winter of 1885–86 was very severe in Kansas and Colorado and entire herds of cattle perished The next year the Montana, Wyoming and Dakota ranges were lashed by blizzards, and when spring came around thousands of carcasses marked the end of the old range days

There was only one way out for those who stayed in the business Good pasture lands were bought and fenced Alfalfa was planted and enough hay was put up to feed the weaker stock through the winter Instead of the big herds of thousands of cattle the western rancher today has only a few hundred Better breeds were introduced which would fatten quickly for market The old longhorn followed the Indian and the buffalo into the land of things that had been

In some sections the old methods of ranging cattle lingered on, and even today in scattered places in the West cattle still graze on the open range There the cowboy can still be found But he too, is passing, for a ranch hand who can dig ditches, build fences, run a mowing machine, and take care of a gasoline engine is far more useful than a cowboy Younger men, who never knew the old range days have learned a little of the old time cowboy's skill They perform today at "rodeos," as exhibitions of roping and "bronco busting" are called

So attractive has this last frontier been to all Americans that, even after it was gone, ranchers who would take care of eastern tourists, give them horses to ride, and show them something of the ways of the "cow country," could make more money than in raising cattle These ranches are known as "dude ranches" *for in the Old West an easterner was called a "dude"* Thus passed *the cow country*, and the last great days of the West But although it has gone, never to return, *it lives* on in the imagination of every American

THE PASSING OF THE WESTERN RANGE

In this painting Frank Hoffman distinguished illustrator, has caught the note of sadness that marks the end of every great romance The cowboy riding out in all his gay regalia meets an old cattleman who has already surrendered to the inevitable and turned farmer For the first time he seems to realize that he and his work are doomed by fences and plowed fields.

CAU'CASUS MOUNTAINS

CAU'CASUS MOUNTAINS Between the Black Sea and the Caspian lies a wide neck of land called the Caucasus, or Caucasia The Caucasus Mountains run across it from east to west and divide it into two parts The northern Caucasus adjoins the Russian plain The southern Caucasus called Transcaucasus, borders on Turkey and Iran It is divided from west to east into the Soviet republics of Georgia (capital Tiflis or Tbilisi), Armenia (capital Erivan), and Azerbaidzhan (capital Baku)

The Caucasus Mountains are young, high, and rugged Great areas lie above the snow line, and 1,400 glaciers have been counted The main range slants from the northwest to the southeast It is 685 miles long and 30 or more miles wide About half way across it stands the extinct volcano Mount Elbrus, the loftiest peak in Europe (18 481 ft) South of the main range stands the Lesser Caucasus Range The two ranges are connected in their centers by the low Suram Mountains In the north, the Kuma and the Terek rivers flow east to the Caspian Sea and the Kuban west to the Sea of Azov In the south, the Kura flows past Tiflis to the Caspian Sea The Araxes River forms part of the southern boundary

A few high, difficult passes cross the mountains The Georgian and Ossetic military roads cross the middle of the range through the Mamison and Dariel passes A railway loops around the east end, squeezing through the narrow Gates of Derbent on the

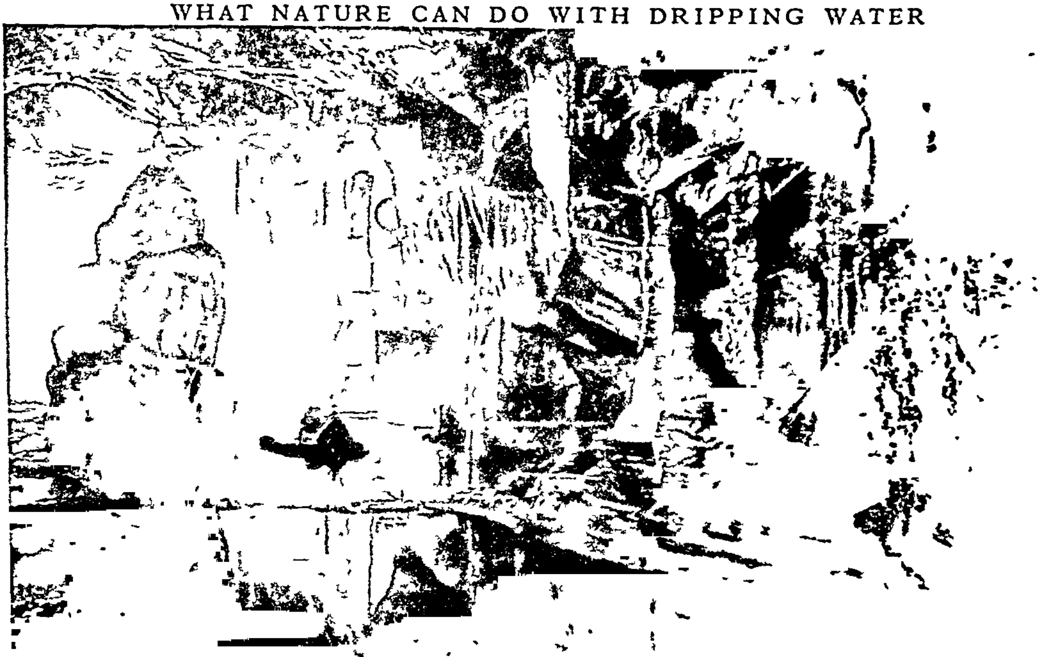
Caspian coast Two short railroads cross the western mountains to the Black Sea

The Caucasus covers an area no larger than Montana, yet it contains a wide variety of climates. In the north, dry land called a steppe stretches from the foot of the mountains. The mountains shelter the Black Sea coast from cold north winds, and the region has an almost tropical climate. Westerly winds bring rainfall of nearly one hundred inches a year. Here luxuriant forests cover the lower mountain slopes. But the lofty mountains keep rain from the hot Caspian coast and it receives less than ten inches a year

Many of them settled in the mountain fastnesses and long maintained their independence. The most warlike of all were the Georgians, in the Transcaucasus, and the Circassians, who lived on the north slopes of the mountains. In 1864, after 35 years of bitter fighting, Russia gained control of the entire Caucasus. Revolts broke out again after the Russian revolution (1917) and were put down by the Soviet government During the second World War, Hitler made a desperate attempt to reach the rich Caucasian oil fields.

In 1795 a German ethnologist, Johann Blumenbach, coined the name Caucasian race for one of the five great divisions of mankind. He believed that the mountaineers of the Caucasus were the most perfect type of the white race.

WHAT NATURE CAN DO WITH DRIPPING WATER



What a task it would be for a human architect to decorate a hall of such glittering beauty! Yet nature did it easily, using nothing but limestone and dripping water to hang those stalactites from the ceiling and to build up those stalagmites from the floor. This marvelous example of nature's handiwork is to be found in a cave near Cheddar, in Somersetshire, England.

According to Greek legend, Prometheus was chained to a rock in the Caucasus Mountains for daring to steal fire from heaven The Argonauts sought the Golden Fleece in the fertile plain of Colchis, on the Black Sea. Today the Colchis (in Georgia) produces grapes, oranges and lemons, tobacco, tea, and tung oil The nearby mountains supply Circassian walnut Cotton is raised on irrigated lands in Armenia and Azerbaidzhan. Cattle are pastured in the mountains and on the northern steppes. Most of Russia's petroleum comes from the Apsheron Peninsula in Azerbaidzhan. The center of production is the great oil city, Baku. Oil is obtained also in the foothills around Maikop and Grozny. Rich manganese deposits are mined and some coal, copper, molybdenum, arsenic, and tungsten. (*See also* Armenia; Georgia; Russia.)

The Freedom-Loving Mountaineers

In prehistoric times various wandering tribes skirted the Caucasus in migrating from Asia to Europe.

CAVE. Thousands of great caves, or caverns, lie beneath the surface of the earth. One of the largest is Mammoth Cave, in Kentucky. Its walls rise 120 feet in some places The largest of its chambers covers one and one-half acres. Great stone pendants hang like icicles from the ceiling. Columns and cones rise from the floor. When properly lighted with electricity, these strange formations glow with color.

Mammoth Cave is a limestone cavern. Water hollowed out its many chambers. The water seeped through the topsoil, then through cracks in a layer of limestone. Below, it washed out clay deposits down to another limestone layer. The water continues to drip from the ceiling. It leaves particles of lime on the ceiling. In time, a "stalactite" is formed, hanging from the roof. The drops deposit more lime as they

MARVELS OF NATURE'S UNDERGROUND ARCHITECTURE

The rich pointed drapery in the "Throne Room" of the Caverns of Luray, Va. (upper left) is a masterpiece fashioned by drops of water. In Mammoth Cave (upper right) the underground Echo River leads a boatload of visitors through eerie realms of light and shadow. In the old entrance to Mammoth Cave stand the "Ruins of Karnak" (lower right), so called from their resemblance to the columns in the ancient temple in Egypt.

splash on the floor, and so a stalagmite is formed. Often stalactites and their stalagmites meet to form massive pillars, pipes, and curtains of stone.

Two Famous National Parks

About 150 miles of passages have been explored in Mammoth Cave. Since 1936 it has been a national park. One of its curiosities is the pale, sightless fish which have lost their coloring and their vision through living for generations in darkness.

Carlsbad Caverns in southeastern New Mexico are believed to be the largest in the world, although they are still only partially explored. They were discovered in 1901 by Jim White, a cowboy whose curiosity was aroused by a nightly swarm of millions of bats pouring like a spiral column of smoke from the cavern mouth. This flight is still a spectacle that amazes Carlsbad visitors. In 1923 the area was made a national monument and in 1930 a national park. The tremendous size of the rooms and the beauty of the formations are unequalled. (*See* National Parks.)

Caves appear in the legends and superstitions of many peoples. The cave-palaces of the Harz Mountains in Germany are supposed to have sheltered the Little Men, and Frederick Barbarossa is said to await the end of his long sleep in a Thuringian cave (*see* Frederick I). Roman sibyls and nymphs lived in caves, and in Greece caves were the temples of the gods and the seat of the Delphic and other famous oracles which attracted many visitors (*see* Delphi).

More interesting than the legends, however, is the fact that from the remotest periods of history animals and men have inhabited caves, and from the remains they left men of science have been enabled to read the early chapters in the history of human and animal life. (*See* Man.)

The Cave Dwellers of Today

Even today thousands of human beings live in caves in various parts of the Old World. In early times great numbers of tunnels and chambers were cut in the hillsides of England, Flanders, and France to serve as refuges for entire communities in time of invasion. Some of these are still so numerous as to form underground villages like the village of Troo, about 150 miles south of Paris, most of whose inhabitants still live wholly or in part underground. Some of these huge caverns in northern France were used as shelters for entire regiments during the first World War. Other such rock villages have been found in out-of-the-way places in Spain, Italy, Sicily, China, India, Egypt, and especially in Syria.

Caves always have been favorite haunts of smugglers, bandits, and other fugitives. They have even been used as tombs and places of worship. Many marvelous cave temples exist in India, and the rock-hewn tombs of Palestine and of Egypt, and the Catacombs of Rome probably owe their existence to the ancient practise of burial in hollows in rocks.

One of the grandest natural caverns is Fingal's Cave, on the island of Staffa on the west coast of Scotland, whose sides are formed of ranges of basaltic columns which are almost as regular as hewn stone. Among famous stalactitic caves are Madison's Cave, and Luray Cavern, in Virginia; Wyandotte Cave, in Indiana, and a number high above the sea in the Rock of Gibraltar, where remains of Neolithic cave dwellers have been found. Wind Cave in the Black Hills of South Dakota is noted for its size and beauty. In Iceland and Hawaii are many caves formed by the lava from volcanoes, and in France and Switzerland are huge ice caves. The Ozark region of Missouri is noted for its numerous caves, particularly Onandaga Cavern. The Cumberland Mountains in Tennessee contain some curious caverns, in one of which, at a depth of 400 feet, a river was found with a current sufficiently powerful to turn a mill. Another cave in the same state is named Big Bone Cave, from mastodon bones discovered there. Caves in northern California are also rich in animal remains.

Caves are principally formed in limestone and gypsum as the result of the solvent action of water. Lava caves appear to have been produced in many cases by the expansion of steam and gases. Sea waves sometimes hollow out caves in the cliffs along shores.

A CEDAR OF LEBANON

This magnificent tree (*Cedrus libani*) grows on a mountainside in Syria. It is about 80 feet tall.

CAVOUR (*kä-vūr'*), **CAMILLO BENSO, COUNT DI** (1810–1861). This shrewd practical Italian nobleman has been called the greatest statesman of the 19th century. He did more than any other person to unite the scattered states of the Italian peninsula into a single kingdom. Mazzini inspired the Italians to demand liberty and unity; Garibaldi was their military hero, but Cavour—the skillful organizer, the realistic politician, the astute diplomat—made union a reality (*see* Garibaldi; Italy; Mazzini).

Count di Cavour was born at Turin, the capital of Sardinia-Piedmont, Aug. 10, 1810. He was educated for a military career and became an officer of engineers at the age of 16. But he developed liberal political ideas and resigned his commission five years later. He traveled in France and England studying political and social institutions. He also learned the latest agricultural methods, and he came to believe that political liberty for his country would be impossible without industrial prosperity.

When he returned to the family estates in north Italy, he managed them well enough to become wealthy. Meanwhile he directed his efforts toward improving Italian agriculture and building factories and railroads. He hoped that railways would tie the peninsula together. He founded the liberal newspaper *Il Risorgimento* at Turin in 1847.

At that time the small kingdoms in Italy were nearly all ruled by petty tyrants and dominated by Austria. Cavour believed that Austria could be expelled only if some Italian state became strong enough to do so and had backing from the great powers. When he became prime minister of Sardinia-Piedmont, he worked to make the nation into such a state. To gain the favor of Britain and France he sent troops to the Crimean War (*see* Crimea).

Shrewd diplomacy won him the friendship of Napoleon III of France and his pledge to aid Piedmont in case of war with Austria. In April 1859 the conflict began. After three months, when victory seemed assured, Napoleon suddenly signed an armistice. But the movement for union of Italy had gained too much momentum to be stopped. The next year Garibaldi, with Cavour's secret aid, conquered Naples. One state after another joined the cause, and in February 1861 the struggle was over. In March, Victor Emanuel II was proclaimed king of Italy. Three months later Cavour died, worn out by his patriotic labors.

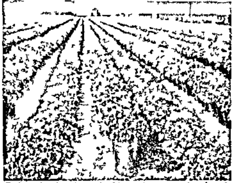
CEDAR. Even before the pyramids of Egypt were built, cedar was a highly prized wood. It is easily worked; it resists weather and insect pests, and the brownish color and aromatic smell are pleasing.

From those early times until now, true cedar has come from the tree called the cedar of Lebanon. This

tree grows on the mountains of Syria to a height of 80 feet Its thick, clumped branches often spread wider than its height It belongs to the pine family, and like pines its needles grow in clusters, but it may have as many as 30 in a cluster Related trees are the deodar, or "divine tree," of the Himalayas, the Atlantic cedar of North Africa, and the Cyprus cedar of Cyprus Island

In the United States, many trees which have aromatic wood are called cedars, but most of them are cypress or juniper (*see* Juniper) The West Indian, Jamaica or "cigar box" cedar belongs to the mahogany family Cedarwood oil used in perfumes, paints, and varnishes and with oil-immersion lenses of microscopes, is obtained from the juniper called eastern red cedar (*See also* individual cedars by name, as Incense cedar, in the FACT-INDEX)

KEEPING CELERY STALKS WHITE



To blanch celery for early shipment growers place boards around the rows of plants

CELEBES (*sĕl'ĕ-bez*) The island of Celebes is one of the chief "crossroads" in the East Indies It lies between Borneo, the Moluccas, the Philippines, and Java Hence this Indonesian territory stands at a crossroads of sea traffic between these islands

On it Asiatic plants and animals meet Australian types, since it is near the imaginary division (Wallace's Line) between the Asiatic and Australian regions Geologists also consider the island a meeting place of geological forces They believe that an old mass of hard rock stood here as an anchor when the surrounding region was wrinkled into chains of islands This movement gave the island its odd shape, like four long arms twisting outward from a center around Mount Koruwe Active volcanoes exist on the northern arm, Minahassa.

The southeastern slopes, which receive more than 100 inches of rain a year from monsoon winds, are covered with dense tropical forests But some sheltered localities, such as Palu, receive only about 20 inches Mean temperatures reach nearly 100° F at sea level, and fall to about 50° on the mountain heights

Many lakes dot the valleys, but the rivers are mere tumbling mountain streams The chief products are copra, coffee, gum copal, spices, rattan, and shells Forest products include oak, teak, cedar, sandalwood, betel nut, cloves, and nutmeg Gold, silver, petroleum, iron ore, and limestone are exported

The natives are of mixed race and culture The primitive Toals, who resemble Australian bushmen, live in the forest depths The north side of Minahassa has the civilized Christian Minahassese, who are related to the Maoris of New Zealand

Celebes, often called Sulawesi, has an area of 72 000 square miles Population (1950 est) 5 500 000 Largest cities are Makassar, the capital (400 000) and Manado (50 000) (*See also* East Indies Indonesia)

CELERY. In its wild state, celery is a tough, bitter marsh weed, found throughout northern Europe But cultivation has changed this weed into an appetizing food The first American crop was grown near Kalamazoo, Mich , about 1874

Celery is grown from seed, on moist land, or with irrigation and fertilizer Bitter flavor is avoided by keeping the plants from getting fully green With some varieties this is done by growing the plants densely in thick rows Most celery is kept white, or blanched, by banking the stalks with earth or enclosing them in boards, papers, or tiles Blanching requires from a few days to two weeks Pascal celery is grown unblanched Where spring frost occurs, early crops are planted in hot or cold frames The young plants are later set out in fields A crop matures in about four months In warm regions seeds are planted in the open, and growth is slower

Most seed is obtained from specially grown two-year-old plants One ounce contains about 70 000 seeds and yields perhaps 10 000 grown plants When ground and mixed with salt, the seed provides celery salt California, Florida, New York, and Michigan produce about two-thirds of the American crop Celery (*Apium graveolens*) belongs with parsley and carrots to the family *Umbelliferae* One form, *celeriac*, is grown in Europe for its turniplike root

CELL. Living things come in all shapes and sizes Some towering trees have branches more than 300 feet above the forest floor There are spiny crabs and graceful fishes There are almost shapeless living things so small we cannot see them

Yet in two ways all these things are alike First, they contain the living, jellylike material called *protoplasm* (*see* Life) Second, this living jelly is put together in units called cells Every living thing contains at least one cell Many have millions or billions of cells, combined to make a body.

Cells are of all sizes The yolk of an egg is a single huge cell An ostrich egg contains a cell more than three inches across The smallest cells are those of bacteria (*see* Bacteria) Each of these tiny plants is a single cell Seven million of them would fit on the period at the end of this sentence

One Celled Living Things

Bacteria are also the simplest cells in structure Some of them are just little balls of protoplasm The surface of the protoplasm is a thin, tough membrane The protoplasm inside the membrane is called *cytoplasm* Scattered through the cytoplasm are tiny grains, droplets of liquid, and bubbly particles A bacterial cell covers itself with a clear, stiff *cell wall*, outside the membrane

The simplest animal cells are those of tiny creatures called *amoebas* (*see* Amoeba). A whole amoeba is a speck of protoplasm forming a single cell. As with most animal cells, the amoeba's body has no cell wall. Its membrane is so soft that the cell can change shape easily and can "swallow" food simply by flowing around it. The cytoplasm within is bubbly, but the grainy material that is scattered through a bacterial cell is collected into a round or flattened *nucleus*. Clear droplets called *vacuoles* digest food and push waste material out through the membrane.

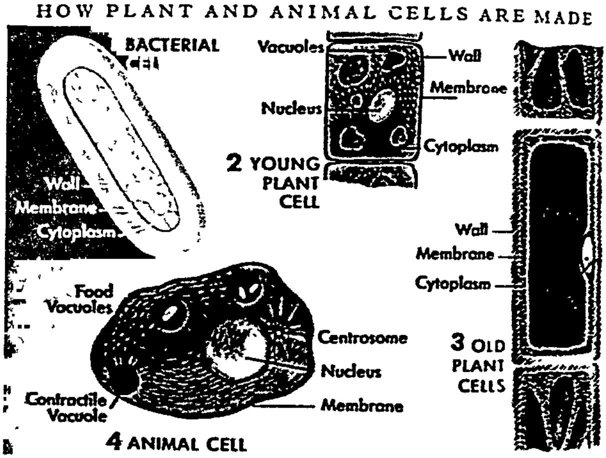
Cells in Large Plants and Animals

Many cells together make up the structure of a tree or the body of a dog. Most of them are so small that they must be magnified many times before they can be seen. These cells are different in some ways from those of single-celled plants and animals. A typical plant cell contains cytoplasm, a membrane, and a nucleus. The membrane is covered with a water-soaked cell wall of woody material called *cellulose* (*see* Cellulose). In a young plant this wall is thick, and the cytoplasm contains several vacuoles filled with *cell sap*, a clear watery fluid. As the cell grows old, its wall becomes thicker and the vacuoles join together. Often they form a single vacuole that fills most of the cell. The cytoplasm then becomes a thin layer between the vacuoles or between the one big vacuole and the membrane. The nucleus lies in this layer, at one side of the cell.

Walls are not actual parts of cells since they consist of lifeless cellulose. But these cell walls give a plant stiffness, allowing it to grow large and tall. They also protect a plant from harm.

Animal cells never have cellulose walls, though they sometimes have flexible sheaths made largely of protein material. Thus they can change in size and shape and the whole animal can move about. Animals never grow as big as the largest plants, however, and most of them cannot stand such great changes of heat and moisture as plants can endure. Most animals need structures such as bones to support their bodies and shells or tough skin to protect them.

HOW PLANT AND ANIMAL CELLS ARE MADE



A bacterial cell (1) is the simplest of all plants. More complex plant cells (2, 3) have a nucleus and vacuoles which expand as the cells grow old. A typical one-celled animal (4) digests food and expels wastes by means of vacuoles; the centrosome plays an important part in cell division.

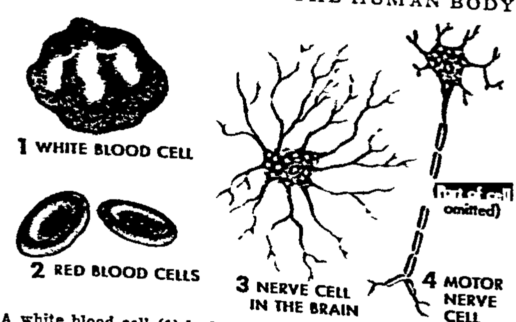
Simple and Specialized Cells

Even very simple cells, like those of bacteria, must be able to do several different things in order to live, grow, and reproduce. Some have special parts to carry on special functions. A few have "eye spots" that respond to light, and some have purplish grains that make food from lifeless material.

In many-celled plants and animals, however, many of the life functions are divided among different kinds of cells. In plants, some cells specialize in getting water from the ground while others build sturdy stems and still others form the cells that produce new plants. An animal such as a dog or cat has about fifty different kinds of cells. These form muscles, hair, eyes, teeth, and many other structures. None of these cells can live alone, but all of them together make up a living dog or cat.

A full-grown person probably has a *million billion* cells in his body. A drop of blood contains at least 5 million and a square inch of skin 6 million. The simplest of these are white blood cells; they are not very different from some types of amoebas. The most specialized are probably nerve cells. Such a cell has an irregular body containing the nucleus. Long, delicate branches run out from this. Nerve cells which reach the fingers and toes, for example, have branches three to six feet long (*see* Nerves).

VARIETY IN CELLS OF THE HUMAN BODY



A white blood cell (1) looks and behaves like an amoeba. Red blood cells (2) carry food and oxygen; they lack a nucleus. A brain cell (3) is delicately branched. A motor nerve cell (4) has a tremendously long extension to the muscle it controls.

How Cells Use Food and Water

Whatever its function, every cell has a membrane which holds it together. The membrane also links the cell with the outside world, for food and water to nourish and repair the cell must come through this film. It is very thin and is also *semipermeable*. This means that certain substances can pass through it but others cannot. A membrane lets useful substances into the cell while keeping out most of those that are useless or harmful. A cell gets rid of waste materials (*excretes* them) through the membrane.

Water is one of the most important materials that pass into a cell. All living things must have it for their protoplasm. It keeps membranes moist and makes the greater part of fluids such as sap, blood and lymph. The water in cell sap strengthens leaves and stems. Without enough water these droop and sometimes die.

Green plants make sugary food by combining water with the gas carbon dioxide. Hairlike cells on the roots absorb water by *osmosis* (*see* Liquid). The water goes up through hollow, dead cells to the leaves. There other cells combine it with carbon dioxide from the air (*see* Plant Life). The sugary product is promptly dissolved in food sap. This passes through living cells and reaches every part of the plant.

Animals need ready made food to keep their cells alive. Many-celled animals digest food in special organs and absorb it through cell membranes.

Living things use food in three ways. Part of it is turned into protoplasm to build up cells or to replace parts that are worn or damaged. Part is turned into nonliving structures such as cell walls, bones and scales. The rest is changed so as to release energy for the everyday work of living.

Energy from Food

Most plants and animals secure energy by combining food with oxygen. Plants absorb oxygen through cells of their leaves and stems. Some animals absorb it through their skins or gills.

In the human body oxygen is taken from air in the lungs. There it is combined with reddish yellow material in round flat cells of the blood. These cells, the *red corpuscles*, carry oxygen to every part of the body (*see* Blood). Living cells combine oxygen with food in a slow sort of burning called *oxidation*. This provides them with energy for growth, movement and other activities.

Cell Growth and Size

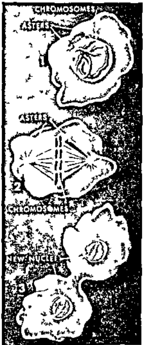
Cells grow in two ways: by using food and by storing it. Food that is used to make protoplasm builds up the living parts of the cell. Food stored in grains or droplets, however, merely makes the cell bigger. The huge egg cells of hens, ostriches and some reptiles consist of a small amount of living protoplasm and a great deal of stored up food.

Though cells can grow rapidly, they do not keep on growing forever. The size of every cell has a natural limit. This is determined partly by the things it must do to live. Small cells, for instance, have a great deal of membrane in proportion to their size, but big ones have very little. Cells that live actively need a large membrane to absorb great quantities of food, water and oxygen and so the cells themselves remain small. Cells that merely remain alive need less membrane and they can become much larger. The difference is well shown by an egg, whose cell is large before it begins to develop. As the cell turns to a chick, however, it forms active cells as small as those in human bodies. For similar reasons a sluggish amoeba is several times larger than other one-celled creatures that swim about actively and prey upon creatures bigger than they are themselves.

How Full Grown Cells Divide

When a healthy cell reaches full size it does not simply stop growing. It divides into new cells and when these are grown they divide again. In simple creatures such as bacteria the cell merely pinches in two until the membrane completely surrounds each half. These become new cells—separate living things. This process is called *fission*.

DIVISION BY MITOSIS



1 In mitosis chromosomes form in the nucleus and the centrosome divides into starlike asters. 2 The chromosomes split and the asters pull the halves apart. 3 New nuclei form around the chromosomes and finally the whole cell divides.

Cells with nuclei divide by a more complex process called *mitosis*. In the nucleus are countless tiny grains containing *genes*, the particles that determine inherited characters such as size, shape and color. In mitosis these grains come together in a definite order and form a long thread. This breaks up into structures known as *chromosomes*. Each chromosome splits lengthwise, forming two new ones. These carry half of every gene that went into the old one.

Meanwhile another structure called the *centrosome* divides into two starlike *asters*. These go to opposite sides of the cell. Then a film around the nucleus disappears and fibers from each aster pull the chromosomes apart. Separate nuclei form around the chromosomes and finally the cell membrane pinches together to form two new cells.

Cells of some plants divide in this way. Others form fibers in spindles that pull the chromosomes apart. Cells which divide by fission probably have some comparable method of splitting the genes. This process, however, has never been seen under a microscope by scientists. The article on Heredity tells how chromosomes and genes pass hereditary characters on from one generation to the next.

CELLOPHANE. Thanks to the invention of cellophane hundreds of products on the market today are put up in attractive transparent packages. These include items which soil easily, such as lamp shades, stockings and light-colored sweaters; items which must be kept in moistureproof containers, such as cookies, potato chips and cigarettes; and items which housewives like to see before they buy, such as fruits

vegetables, and meat. Both clear and colored varieties of cellophane are also widely used for fancy gift wrappings and to make such products as adhesive ("Scotch") tape and drinking straws.

Cellophane is a regenerated cellulose prepared from the organic substance called *viscose* (*see* Cellulose). The molasseslike viscose is extruded through a thin slit and solidified in an acid bath. The continuous ribbon of cellophane then travels through other baths which remove the acid and other processing chemicals. Finally, after passing through a glycerin solution which gives it flexibility, it is dried on hot rollers. Most cellophane is made moistureproof by passing it through a lacquer bath before drying. Colored cellophane is run through dye before the glycerin bath.

CELLULOSE. Nature makes use of cellulose as stiffening material in plants. Men make use of it in hundreds of ways and in thousands of articles. These range from wooden houses to gunpowder and from newspapers to automobile lacquer.

A great deal of cellulose is used in its unchanged, natural form. Cotton fibers are almost pure cellulose, and other vegetable fibers, such as flax and jute, are mostly cellulose. Therefore, cotton and linen fabrics, manila rope, coco matting, and a host of common products made from vegetable fibers are largely natural cellulose (*see* Fibers).

Cellulose is combined with the complex substance lignin in the stiff, woody parts of trees. Wood, of course, is used in its natural form, and great quantities go into the making of paper (*see* Paper; Wood).

Chemically, cellulose is a carbohydrate belonging to the group called *polysaccharides*. These compounds are related to the group containing table sugar (*see* Sugar). Cellulose has the formula $(C_6H_{10}O_5)_x$, indicating that it consists of an indefinite number of molecules linked in long chains, or *polymers*.

SOME CELLULOSE PRODUCTS AND THEIR MANUFACTURE

Regenerated Cellulose

Cellulose xanthate. Used in manufacture of viscose rayon; cellophane; sausage casings; sizing and waterproofing materials; cellulose sponges; bottle caps.

Cuprammonium cellulose. Used principally in manufacture of Bemberg rayon.

Cellulose Organic Esters

Cellulose acetate. Used in manufacture of acetate rayon; plastics; safety photographic film; paints, lacquers, and varnishes; safety glass; filaments; materials for sizing, finishing, and waterproofing fabrics.

Mixed esters. Cellulose acetate butyrate one of the most useful of these; employed as plastic molding compound and as airplane dope.

Cellulose Nitrates

Pyroxylin (cellulose nitrate containing 10.7 to 12.2 per cent nitrogen). Used in manufacture of Celluloid and other plastics; artificial fibers; photographic film; lacquers, paints, and resins; collodions.

Guncotton (cellulose nitrate containing 12.3 to 13.8 per cent nitrogen). Used in manufacture of smokeless powder; rocket and mortar propellant powders; blasting powder and other high explosives.

Cellulose Ethers

Methyl and ethyl cellulose. Used in manufacture of plastics; sizing and finishing materials for textiles; collodions for medical purposes and other medicinal preparations; adhesives.

Carboxylmethyl cellulose. Used in manufacture of plastics; waterproofing and sizing materials; drilling fluids; detergents; food preservatives; medicinal preparations.

Oxidized Cellulose

Used in manufacture of surgical gauze and hemostatic (blood-clotting) agents.

Creating New Substances from Cellulose

The cellulose chemical industries get most of their raw cellulose from paper mills. It comes in the form of thick sheets of dried pulp, pure white and fluffy. These are nearly pure cellulose, as the lignin, gums, and resin have been removed at the mill. Raw cellulose also comes as baled cotton linters from cotton mills. Linters are the short fibers that stick to the cotton seeds after ginning.

The chief task of the cellulose chemist is to change the fluffy, matted fibers of raw cellulose to a fluid form which can be spun, molded, or extruded as useful products. His task is complicated by the fact that cellulose does not dissolve in any known solvent. He therefore attacks it with chemicals that change it to soluble compounds which can be used in manufacturing processes. In certain processes, the final product is *regenerated cellulose*—cellulose that has been changed back to its original chemical form. In others, the final product is a chemical compound. The most important of these products are shown in the accompanying table.

Most regenerated cellulose is prepared by the *xanthate*, or *viscose*, process. Cellulose is first steeped in sodium hydroxide, as in the mercerizing of cotton fabrics (*see* Mercerizing). The result is a substance called *alkali cellulose*, one of the fundamental materials of cellulose chemistry. It is further treated with carbon disulfide and yields a crumbly orange solid called *cellulose xanthate*. Dissolved in dilute sodium hydroxide, this becomes a sticky fluid called *viscose*. When viscose is run through dilute sulfuric acid, it solidifies as a clear, transparent substance that consists almost entirely of pure cellulose. Viscose products, such as rayon and cellophane, are made by this process (*see* Rayon; Cellophane).

In the *cuprammonium* process the cellulose is changed to a new compound by an ammonia-copper hydroxide solution. This cuprammonium cellulose is spun as Bemberg rayon yarn in an acid bath.

In other processes the final cellulose product is a compound. The principal compounds are esters, nitrates, ethers, and oxides. *Cellulose acetate*, the most important ester, is prepared by steeping cellulose in acetic acid and acetic anhydride. For spinning and other manufacturing techniques, it is dissolved in acetone. The mixed ester *cellulose acetate*

MINIATURE GREENHOUSES OF CELLULOSE PLASTIC

Nurserymen and home gardeners use these clear plastic plant covers to protect young plants from wind and late frosts They are made of cellulose acetate butyrate

butyrate is similarly prepared but a mixture of acetic and butyric acids is used

Cellulose nitrate or *nitrocellulose* is prepared by steeping cotton linters in nitric acid or a mixture of nitric and sulfuric acids Nitrocellulose with a low nitrate content is called *pyroxylin* This brittle solid is treated with camphor to make Celluloid For the manufacture of collodion and certain lacquers pyroxylin is dissolved in organic solvents (*see* Collodion Lacquer) Highly nitrated nitrocellulose is known as *guncotton* This is a basic material in the manufacture of many explosives (*see* Explosives)

The *cellulose ethers* are less subject to attack by acids and alkalis than the esters They find a wide variety of uses They are prepared by treating alkali cellulose with an alkyl chloride or alkyl sulfate

Hundreds of cellulose compounds exist besides those already mentioned *Oxidized cellulose* used in various ways by the medical profession is perhaps the most important of these Many others find limited use in agriculture and industry Still other cellulose products are known but have no commercial use as yet So varied are the forms and compounds of cellulose that the chemistry of cellulose comprises a large and distinct branch of organic chemistry

CELTS (*sĕlts* or *kĕlts*) Among the peoples who inhabited Europe in very ancient times were the warlike Celts These muscular red haired wanderers had probably come from the distant steppes beyond the Caspian Sea By 500 B C they were living in northeast France southwest Germany and Bohemia The Celts who were also called Gauls continued to migrate in all directions

About 400 B C Celtic tribes crossed the Swiss Alps into northern Italy After capturing the fertile Po Valley region they laid siege to Rome (*see* Roman History) At the same time other groups of Celts pushed down into France and Spain eastward to Asia Minor and westward to the British Isles To what is now France they gave the ancient name of Gaul In Asia Minor they founded the kingdom of Galatia St Paul s Epistle to the Galatians in the New Testament is addressed to the descendants of these Celts In Britain Celtic warriors overran and conquered the islands (*see* English History)

Celtic Life and Religion

The Celts ruled through a loose tribal organization Each tribe had a chief nobles freemen and slaves The tribal home was usually a fortified village with fields and pastures outside Many of these forts were built on hilltops Often the tribes warred against each other and when one tribe overpowered several others its chief held the rank of king

The Celts brought many new skills to the peoples they conquered They knew how to smelt iron and forge it into useful implements They decorated their helmets shields and arms with artistic metal work and enameling The Celts were also adept in such practical matters as curing hams keeping bees and making wooden barrels

Celtic priests were called *Druids* and their religion *Druidism* Little is known of the Druids because their rites were never written down Apparently their gods were similar to those of other early peoples The Druids of Gaul were both judges and priests who sacrificed criminals to their gods The Druids of Britain were chiefly religious teachers

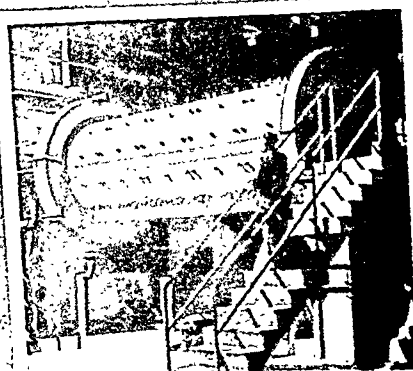
Only men of good family could become Druids. Membership was highly prized because Druids did not have to fight or pay taxes The Druids taught that the soul was immortal passing after death from one person to another They deemed the mistletoe sacred especially if grown on an oak tree The oak was also sacred and Druids often held their rites in an oak forest Wise in the lore of plants animals and stars the Druids were also magicians and astrologers Many ancient stone monuments were once thought to have been built by Druids but scientists now date them from pre-Celtic times (*see* Stone Age)

The Celtic domination of western Europe lasted only a few centuries In time the Romans made Italy Gaul and much of Britain into Roman provinces The Carthaginians overpowered the Celts in Spain and German tribes drove the Celts out of the Rhine Valley Following the Roman conquest the Anglo-Saxon invasion wiped out most traces of Celtic culture in England Only on the fringe of Europe did the Celts manage to keep their distinctive traits and languages—in Brittany the Isle of Man Wales Ireland and the Scottish Highlands There traces of Celtic culture still survive in folklore and in the Breton Manx Welsh Erse and Gaelic languages

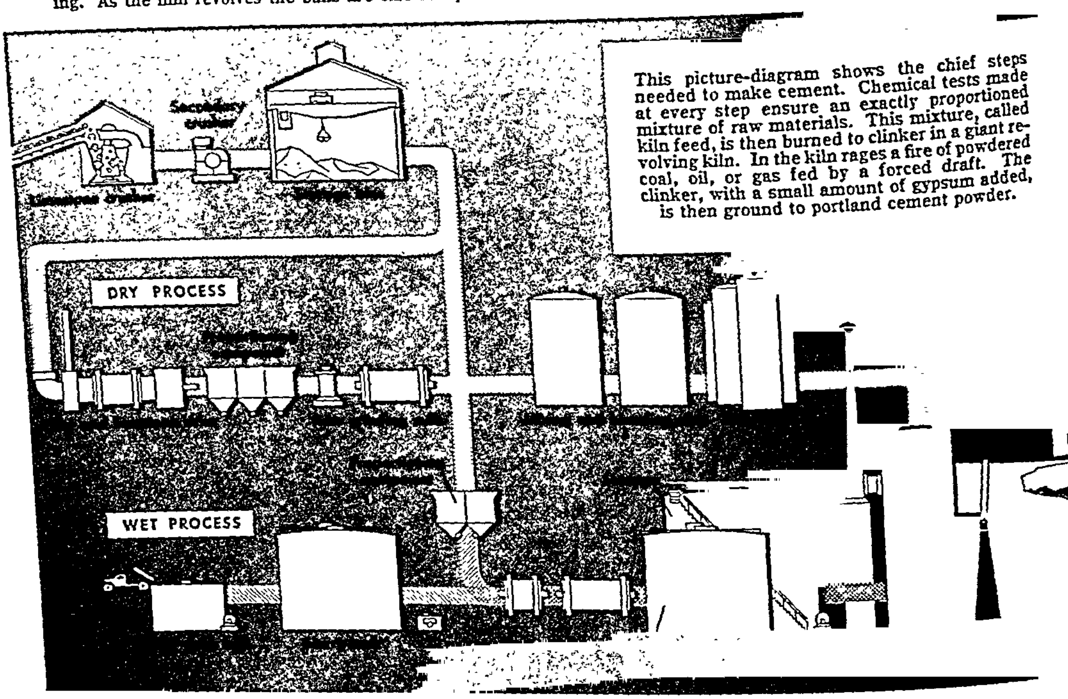
The name Celtic Renaissance was given to a revival of interest in Celtic languages literatures and history which began in the late 1800 s The revival was especially strong in Ireland where it led to the writing of plays with Irish Celtic themes This new interest in the past even helped the Irish struggle for independence The Irish language (Erse or Irish Gaelic) is now an official language of Ireland (*See also* Ireland, Irish Literature)

A CEMENT PLANT AND HOW IT WORKS

A modern cement plant needs huge machines to make big rocks and clay into a powder as fine as flour. The huge tube that extends from one building to another is a kiln. It revolves slowly; through it roars a fire hot enough to melt iron.



The machine at the left breaks rocks as big as a piano into six-inch pieces. It is called a *gyratory crusher*. In the center is a *ball mill*. The steel balls in the mill do the grinding. As the mill revolves the balls are carried upward and dropped onto the materials to crush them. Usually materials are ground first to a coarse powder in one mill and then to a fine powder in a second. At the right is the inside of a ball mill. The pounding gradually reduces the size of the balls.



This picture-diagram shows the chief steps needed to make cement. Chemical tests made at every step ensure an exactly proportioned mixture of raw materials. This mixture, called kiln feed, is then burned to clinker in a giant revolving kiln. In the kiln rages a fire of powdered coal, oil, or gas fed by a forced draft. The clinker, with a small amount of gypsum added, is then ground to portland cement powder.

The POWDER *That Makes* ARTIFICIAL STONE

CEMENT Glues pastes and some plastics used to stick things together are all properly called cements Most are termed adhesives or the word cement is joined with a descriptive word as in the term rubber cement When the word cement is used alone generally *portland cement* is meant Portland cement when combined with water forms a paste which binds sand gravel and stone into a rock like mass called *concrete*

Because concrete has so many valuable uses portland cement has been called a magic powder With it engineers build strong foundations and great buildings and bridges lay highways and sidewalks line tunnels and make posts shingles sewer and water pipes and many other useful things (*see* Concrete)

What Is Portland Cement?

Portland cement powder is a chemical mixture of calcium silica iron and aluminum minerals Portland cement and water *hydrate* or react chemically to form cementing compounds of the water calcium silica iron and aluminum Hydration produces some heat

The natural or raw materials from which portland cement is made are spoken of as *calcareous* and *argillaceous* materials Calcareous materials are calcium compounds usually calcium carbonate or calcite Limestone is the calcareous material most used to make cement Argillaceous materials are compounds of silica Clay is the argillaceous material most used *Chalk* or *marl* are sometimes used in place of limestone (*see* Chalk, Limestone) and *shale* or *slate* in place of clay (*see* Clay Slate) Blast furnace slags contain both calcareous and argillaceous materials and are also used to make cement (*See also* Aluminum Calcium Chemistry, Iron and Steel Silicon)

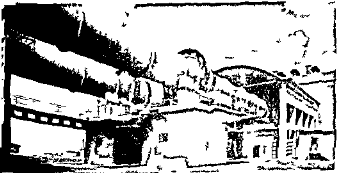
To make portland cement calcareous and argillaceous materials are broken up mixed in proper proportions ground burned and reground with a small amount of *gypsum* (called a retarder because it slows the hardening of cement) Portland cement powder is so finely ground that it can sift through a screen that has 40 000 holes to the square inch

The Kinds of Portland Cement

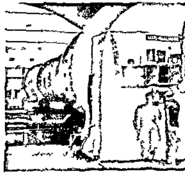
Five types of portland cement are made Type I is used in general concrete construction The concrete gains considerable strength in 7 days and great strength in about 28 days it continues to gain some strength for years Type II resists moderate exposures to sulfate-bearing waters Type III also called a high early strength cement becomes strong enough for use soon after it is placed Type IV generates only a small amount of heat in hydrating and is used to form great masses of concrete as in dams Type V has a very high resistance to sulfate-bearing waters

From these five types various special cements are made *Air-entraining* cement contains soaplike resinous or fatty materials In concrete these materials form billions of microscopic air bubbles per cubic foot These relieve internal pressures by providing room for the expansion of water when it freezes Air entrained concrete also has a high resistance to surface scaling caused by the corrosive action of salts used to melt snow and ice Many states insist on air entrained concrete roads

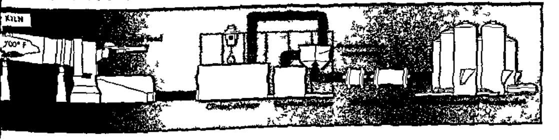
White cement is used on concrete to make guide lines on highways and streets for light-reflecting floors



Cement kilns revolve slowly Some are as much as *500 feet* long Kiln feed is dumped in the upper end As it travels toward the lower end it is dried and burned to clinker



The torrent of flame sweeping the lower end raises the temperature to 2 700° F A specially tinted viewplate permits the kiln man to see clearly into the blazing inferno



FROM CLINKER TO BAGGED CEMENT

From a conveyer belt an inspector lifts a handful of cooled clinker. The conveyer will carry the clinker to storage bins, from which it will be taken for grinding.

Much cement is sold in strong paper bags. Bag-filling machines automatically stop the flow of portland cement powder when 94 pounds have been poured into a bag.

and walls in industrial plants, and for building decoration. By adding color pigments before final grinding, cements can be made almost any color. Cement powder is used as a filler in some paints, and a paint for use on concrete is also made of cement powder.

How Portland Cement Is Made

There are both wet and dry processes for making cement. The principal difference is that in the wet process water is added to the raw materials as they are ground, while in the dry process the materials are ground dry. In the United States more than half and in Europe almost all portland cement is produced by the wet process.

The limestone is broken first into six-inch and smaller sizes in giant crushers. These chunks are next reduced to one inch or smaller in small crushers or hammer mills.

The raw materials (crushed lime and clay, as well as such crushed iron ore and silica sand as is needed) are then brought together in the right proportions. This mixture is ground finely in two stages, usually in rotating steel drums, called *mills*, partly filled with steel balls. The rotating drums carry the balls upward and drop them onto the materials to crush them. In the dry process the materials are dried either before or during grinding.

The ground materials are stored in a silo. By blending the raw materials from several silos the exact chemical composition needed is made. The blended raw materials are called *kiln feed.*

If clay is the argillaceous material used in the wet process, it is mixed with enough water to make a soupy *slurry*. Crushed limestone, other needed materials, and water are added and the slurry passed through grinding mills. The slurry is stored in great tanks, where it is kept well mixed by agitators. By blending slurries from several tanks, the exact chemical composition needed is made and called *kiln feed.*

The Kiln

Cement kilns are monster tubes, some as long as 500 feet and as much as 13 feet in diameter. They revolve from 20 to 80 times an hour. The kilns are mounted at a slight slant, about a half inch per foot. The inside is lined with refractory (fire resistant) brick. Flames, fed by powdered coal, oil, or gas, roar in the lower end, heating 30 feet or more of the kiln to 2,700°F. or higher. A stack at the upper end carries off smoke and gases.

Kiln feed enters the higher end of the tube. The feed is completely dried by the heat as the revolving kiln slowly moves it down the tube toward the flames. In the hottest part of the kiln, about 25 per cent of the feed melts. The liquid mixes with solid feed and forms cement *clinkers* (in the industry collectively called "clinker") about the size of marbles. The kiln discharges the clinker, usually into air coolers.

The clinker, with a small amount of gypsum, is then ground into cement powder by mills much like those used for grinding the raw materials. Cement powder is stored in great silos to await packing and shipping.

How Cement Is Shipped

Cement is shipped either in multilayered paper bags or in bulk. A bag of cement weighs 94 pounds. In the early days the industry shipped cement in barrels that held 376 pounds, equal to four bags. Although little cement is now shipped in barrels, the industry has retained barrel-quantity as the unit for measuring production and sales.

Empty paper bags come to the cement plant sealed at the top. A bag is filled through a valve at its bottom. The valve closes when the filled bag is upended. Bulk cement is pumped through pipes into sealed ships, barges, trucks, or freight cars for shipment.

The History of Construction Cement

Primitive men used clay as a cement to stop up holes in their sapling huts. The Assyrians and Babylonians had no better cement than this for their stone buildings. The Egyptians made a mortar of partially burned gypsum. The stones of the Pyramids were cemented in place with this. The Greeks used little mortar, preferring to shape stones for their great buildings so that when placed they were fastened there by interlocking joints.

The Romans made a cement of slaked lime and volcanic ash. This is called *pozzuolana* after Pozzuoli, a town near Mount Vesuvius. Unlike mortar, pozzuolana is a *hydraulic cement*, which means it will harden under water. The Romans used it in foundations, aqueducts and many buildings, some of which still stand.

Knowledge of how to make hydraulic cement was lost during the Middle Ages. Lime mortar, however, was used in all parts of Europe. Hydraulic cement was rediscovered in the 1750's by John Smeaton, an English engineer. He had been commissioned to rebuild Eddystone lighthouse, which was subjected to wind and wave off the Cornwall coast. Smeaton made a hydraulic cement of a limestone that contained considerable clay. Today such a limestone is called *cement rock* and the cement made of it, *natural cement*. Cement rock is also used to make portland cement.

Others began to experiment with cement rock. Because the deposits varied widely in the amounts of calcium, iron, silica and aluminum they contained, the natural cements varied widely in quality.

The Discovery of Portland Cement

Joseph Aspdin, a bricklayer of Leeds, England, discovered and named portland cement in 1824. He called it "portland" because concrete made from his cement looked like stone quarried on the Isle of Portland.

For his experiments Aspdin took limestone road surfacing which had been powdered under the wheels of heavy carts. He added varying amounts of clay to the powdered limestone until he found the proportions that when burned could be ground into a uniformly strong cement. Aspdin's contribution to cementmaking was the exact proportioning of raw materials.

Other European countries began to make portland cement. In the United States large deposits of cement rock furnished fair quality natural cements for building the Erie Canal and other projects. By 1890 the United States was producing about 10 million barrels of natural cement a year. The United States imported its first European portland cement in 1868. American manufacture of portland cement began in the 1870's.

Early cement kilns were upright. In these layers of fuel and bricks formed of pulverized limestone and clay were burned. Heat varied from one part of a furnace to another and as a consequence the portland cement varied in quality. The uniform quality of European portland cement was highly valued, and increasing amounts of it were imported.

Frederick Ransome, an Englishman, patented a rotary kiln in 1885, the forerunner of the huge modern kilns. Because it operated continuously and produced clinker of uniform burning, the rotary kiln met with quick acceptance.

By 1900 the United States production of portland cement passed the production of natural cements, more than 8 million barrels of each being made in that year. By 1915 natural cement production had dwindled to fewer than one million barrels, while portland cement production had increased to almost 86 million barrels. Now the yearly production of portland cement in the United States is about 245 million barrels, more than one third of the world's production. Canada makes more than 16 million barrels a year.

The CENSUS—COUNTING *America's* MILLIONS

CENSUS. Since early times governments have taken official counts of the people in their country. Ancient Rome gave us the word census, which is Latin for *estimating* or *assessing*. But the United States was the first modern nation to adopt a legal or constitutional provision for taking a census at regular intervals. In 1789 the Constitution (Article I, Section 2) provided that an enumeration (counting) should be taken every ten years. The founding fathers adopted this provision for a practical reason. The number of delegates which any state had in the House of Representatives was based on its population. Thus changes in population had to be recorded to keep the proportion accurate. Beginning in 1790 the federal government has taken such a census every ten years.

Many Uses of the Census of Population

The census of population is still the basis for apportioning the 435 seats in the House of Representatives among the states (*see* Congress of the United States). But today this is only one of the many valuable services contributed by this census. Census takers now ask many questions concerning important aspects of American life. The answers to these questions provide material for measuring many of the changes that have taken place in the nation during the preceding ten years.

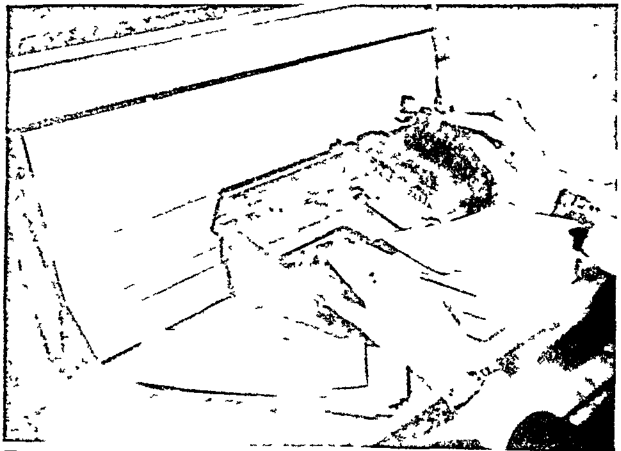
To businessmen the census reveals new markets in areas where population is increasing rapidly. To workers it shows where new job opportunities are developing. Lawmakers find it a guide to many legislative needs of the people. (For a statistical study of the population, called *demography*, in the United States, *see* Population; *see also* United States, section "The American People and Their Achievements.")

What the 1950 Census Covered

The last decennial (ten year) census of population was taken in 1950. This census reported seven facts about every person in the nation—name, relationship to head of family, race, sex, age, marital status, and place of birth. All persons aged 14 or over were asked about their employment and occupation. Foreign-born persons were asked about their citizenship status. The census also listed where each person lived.

Every fifth person was asked an additional series of questions—where he lived the previous year (to show migration by states and changes in farm and city populations), in what country his parents were born, and the extent of his schooling. Census takers asked every fifth person aged 14 or over additional questions about his job. Every 30th person who was unemployed listed his last occupation.

PUNCHING HOLES IN CENSUS CARDS



Here a Census Bureau worker reads the report on one person. To record this information she then uses a machine which punches a series of holes in a card. Such a card is shown in the picture below.

One family out of every five was asked to tell the sources of its income. Every fifth male was asked about his military service. And every 30th person who had been married described his marital status. Women in this group were asked the number of children they had borne.

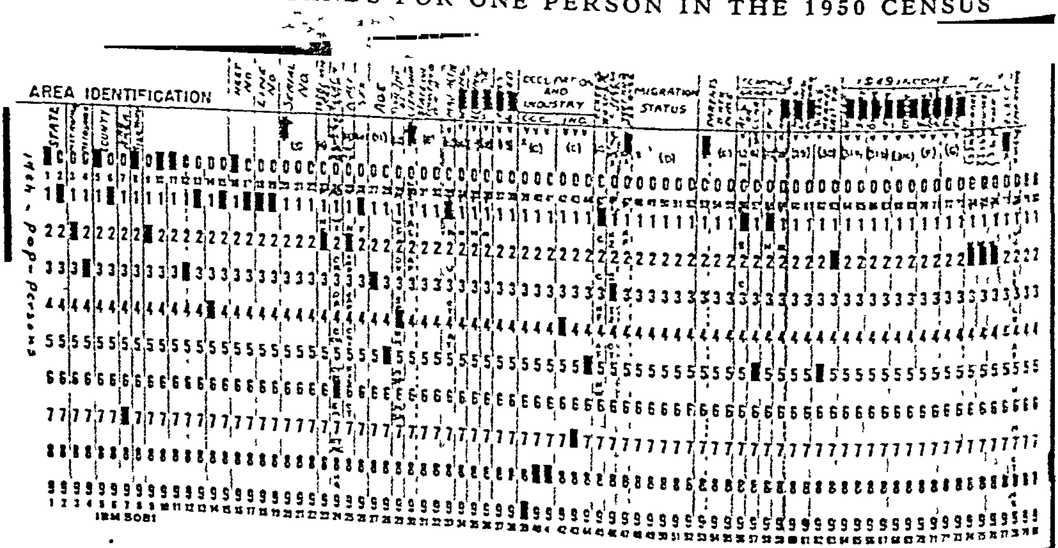
Every person is required to supply answers to census questions. An individual convicted of refusing to answer is liable to a fine and jail sentence. All replies, however, are confidential and cannot be used for purposes of taxation, investigation, or regulation. Moreover, census takers are liable to a fine and jail sentence if they disclose any data regarding individuals.

How Answers Are Gathered and Compiled

The immense body of census information is collected by a great army of workers. For the 1950 census the government hired some 140,000 special census takers. They covered not only all the continental United States but the nation's territories and possessions as well. They plodded from door to door in every city, town, and county in the United States. Some of them used native boats and primitive carts in the tropical islands of Puerto Rico, Hawaii, and the Virgin Islands. Others used Eskimo dog trains in the severe cold of Alaska.

Once the answers are gathered from individuals, the data are assembled in the Bureau of the Census in Washington, D. C., a division of the Department of Commerce. There the information is recorded on millions of cards—one for every person in the United States and its territories and possessions. This stupendous task is performed by electrically operated machines which seem almost human. One machine punches holes in cards, recording by the position of the holes all the information about the person to whom the card is devoted. Another sorts the cards by sex, age, occupation, or any other item in the schedule. Then the tabulating machine gives the totals. Mistakes are rare, for, if an insufficiently punched card is put in the machine stops until the card is removed. The machine, it is estimated, saves nine tenths of the time and two thirds of the cost of handwork, in addi-

THIS CARD STANDS FOR ONE PERSON IN THE 1950 CENSUS



If all the statistical tables for a modern census report had to be compiled by hand the work would take many years. But electrical tabulating machines, working with punched cards, complete the job in a matter of months. There is one card for each man, woman, and child in the United States. The positions of the 66 punched holes in this card show all the facts gathered about one person. The holes in the first 15 columns, for example, locate the person in a definite geographic area and describe the type of community. By means of the holes machines automatically sort the cards into groups and register totals on a tabulating sheet.

tion to being more accurate The final reports are published in many volumes illustrated with maps and charts vastly different from the slender book of 56 pages covering the first census in 1790

In 1950 the Bureau of the Census reclassified certain population groups It counted as urban ' for the first time people who lived in unincorporated places having 2 500 or more inhabitants It also listed persons living in certain suburban areas as part of the urban population These were places with at least 2 000 inhabitants for each square mile on the fringes of cities of 50 000 or more These groups were formerly classified as ' rural nonfarm "

Other Census Bureau Activities

In addition to the ten year (decennial) census of population the Bureau of the Census conducts supplementary censuses Although these are scheduled for definite years Congress must authorize special funds in each case The following are the most important

Census of Housing The *first census of* housing was taken in 1940 In 1949 Congress authorized a census *of housing to be taken* every ten years along with the census of population

The 1950 census of housing reported 12 facts about every dwelling unit These included its condition occupancy and type of sanitary *and water facilities Other questions* were asked for every fifth dwelling unit Such items included the age of the house and its type of heating *equipment*

Census of Agriculture The first national census of agriculture was taken in 1840 Since 1920 it has been taken every fifth year This census reports on the inventory of farms for the year the census is taken (years *ending in* the figures 5 and 0) It computes production figures from the previous year (the years ending in 4 and 9) In 1950 a census of agriculture was taken by more than 65 nations under the guidance of the Food and Agriculture Organization (FAO) of the United Nations

Census of Irrigation and Drainage The first survey of *this type was made in* 1890 This census was taken in conjunction with the census of agriculture in 1910 and 1920 Since that time it has been taken along with alternate censuses of agriculture (in years ending in 0) It reports the number of irrigation enterprises and the total acres irrigated in the 17 western most states and in Arkansas, Florida, and Louisiana

POPULATION FIGURES IN COMPTON S PICTURED ENCYCLOPEDIA

Population figures for the United States This edition of Compton s Pictured Encyclopedia contains final population figures from the latest census (taken in 1950) for all places in the United States and its possessions These figures are indicated by the term *(1950 census)* Such population figures can be found in articles on the United States the various *states and cities and in the Fact-Index They can* also be found on the back of all state maps in color Population characteristics are also based on the 1950 census Such characteristics may be found in the articles on the United States the various states immigration and other subjects

Since 1950 some cities have had a special census In the articles on such cities the results of both the regular and the special census are given

Population figures for foreign nations This edition gives the latest census figures for all nations that take a census If the census was taken before the end of the Second World War a postwar official estimate is added Some of the estimates however were for national populations only In these cases *late estimates for provinces and cities were not* available In some countries no census has ever been taken but the best postwar official estimates available were used In all cases the source and date of the population are indicated

Census of Manufactures Censuses *of this* type have been taken periodically since the first one in 1809 None was taken, *however between 1939 and 1947 because of World War II* Present legislation provides for such a census to be taken covering the *years ending in 3 and 8*

Manufacturers are required by law *to report to* the Bureau of the Census *The Bureau however can*not publish statistics that disclose information reported by individual companies *If a company is the* only one in its industry in a state figures for the company will be omitted from the information *for the* state They will be included in returns for re*gions or other units that are large* enough to prevent identification of the company

The 1947 census of manufacturers covered all manufacturing plants which employed *one or* more persons during the census year (This excluded small sawmills)

This census compiles statistics for industries on employment payrolls, value added by manufacture value of shipments cost of materials expenditures and products manufactured It also publishes statistics for each state and comparative figures for industries and geographic areas

Value added by manufacture provides the best measure of the relative economic importance of manufacturing in different industries and different areas *This figure gives only the value created in the manu*facturing process It is calculated by subtracting from the total value of shipments the cost of materials supplies containers fuel and contract work

Another method of comparison is provided by "value of products shipped ' This figure however includes duplication of values since some products pass through more than one stage of manufacture For example, the value of products shipped from a bakery also includes the value added to the grain by previous processing in a flour mill

Census of Business A census of business was taken covering the years 1929, 1933 1935 1939 and 1948 Congress has scheduled a census of business for the years ending in 3 and 8 Such a census covers chiefly retail and wholesale trade service establishments places of amusement hotels and construction firms It also gathers statistics on sales, employment, payrolls and inventories

Census of Mineral Industries. The first separate census of mineral industries was taken in 1840. It was taken in 1940, and present legislation calls for a report on mineral industries to cover the years ending in 3 and 8.

Census of Governments. The first census of governments was taken in 1850, but the present methods of approach were not used until 1942. Present legislation requires this census to be taken every five years in years ending in the figures 2 and 7.

The census of governments covers more than 150,000 state and local governments. It reports on public finance (revenues, expenditures, and debts) and public-service enterprises. It also shows the number of government employees and the amount of payrolls.

Census of Religious Bodies. The first separate census of religious bodies was taken in 1906. It was taken in years ending in 6 through 1936.

Reports on Foreign Trade. The Bureau of the Census issues weekly, monthly, and annual reports on imports and exports. It also lists the vessels entering and clearing United States harbors, the amount and kind of commodities shipped, and the extent of trade with each foreign country.

The Census Bureau also conducts current surveys on population and other subjects by "sampling"—questioning a cross section of the people. The Bureau then makes estimates for the entire nation based upon this sampling. Such a procedure is followed in the Bureau's report on the nation's labor force. This shows the month-by-month volume of employment and unemployment based upon a survey of 25,000 households in various geographic regions. The Bureau also issues many special reports for other government agencies.

A CENTAUR FAMILY AT PLAY

Perhaps you have heard it said of a good horseman that he "rides like a centaur." The simile refers to those weird mythical creatures—half man, half horse—about whom the Greeks wove so many stories. In both ancient times and modern the centaurs have been a favorite subject of artists.

History of the Census

As far back as Babylonian times a census of agriculture was taken. Ancient China counted its people to determine the revenues and the military strength of the different provinces. Rome regularly took a census of people and of property. This was used to establish the political status of citizens and to assess their military and tax obligations to the state. In the Middle Ages attempts to take a census were rare. The most famous was the census of England taken by order of William the Conqueror and recorded in 1086 in the Domesday Book.

The census in its modern form was closely associated with the rise of democracy, since a periodic count of the population was essential to truly representative government. On the whole, the American people accepted the institution readily. From the beginning the individual reports were kept secret and the information was used only in tables. Unlike the early censuses, these data were not used for exacting taxes and military service from the people of the United States.

The census of 1790 broke down the population total into those who were white (male and female) and those who were colored (slave and free). The white males were further classified into those above and those below 16 years of age. This first census was gathered by federal marshals at a cost of about $44,000. The 1950 census cost about two thousand times as much.

In the United States, as in other countries, the family was the unit of the early censuses. But the United States census of 1850 introduced a revolutionary change. It made the individual the unit and added many new questions, such as age, race, birthplace, and occupation. By this time a number of states had also begun to take censuses. Though these have provided valuable information, the tendency has been to rely on the decennial count of the Federal government.

Soon after 1790 other progressive countries began taking censuses. Two-thirds of the world's people, it is estimated, have been officially counted. Canada takes a census decennially in years ending in the figure 1, as 1941. In conducting the 1950 census of the Americas, the Latin nations adopted United States methods so statistics would be comparable.

CENTAURS (*sĕn'tôrs*). In the old Greek legends, the centaurs were fabulous monsters, half man and half horse. From the waist up, they were shaped like human beings; below, they were like horses. At the feast celebrating the marriage of the king of the Lapithae, they attempted to carry off the bride. A fierce battle followed, and through the assistance of Theseus, a friend of the king, the Lapithae defeated the centaurs and rescued the bride. This battle was depicted in some of the sculptures of the famous Parthenon at Athens.

The most celebrated of the centaurs was Chiron. He was skilled in archery, medicine, and music, in which he had been instructed by Apollo. To this

wise Centaur Apollo intrusted the charge of his own son Aesculapius, who became the patron of physicians Many other famous heroes were Chiron s pupils, notably Jason, Hercules, and Achilles

CEN'TIPEDES These 'hundred legged' creatures —for that is what the name means—are found in damp places all over the world, usually living under stones or timbers Except for one large species in the South those living in the United States are small—five inches long at most—and harmless They eat insects, and the little house centipede dines on flies and roaches

The large and venomous species live only in tropical and subtropical regions Some of them are 12 inches long They live on insects small animals and birds which they capture in their jaws Their bite is fatal to many animals and dangerous to man

The centipede s body is made up of segments each bearing one pair of legs The number of leg bearing segments varies in different species from 15 to 173 or more Thus centipedes may have from 30 to 346 legs The first pair of legs, fused at the base, forms poison fangs The young are hatched from eggs and go through a larval stage

Centipedes are members of the class of *Myriapods*, which have many of the characteristics of insects Most of the American species belong to the genus *Lithobius* the large tropical species, to the genus *Scolopendra*

MILLIPEDES or thousand legs are also members of the Myriapod class They are generally smaller than the centipedes and differ from them in having two pairs of legs attached to most of their body segments Thus some are equipped with more than 400 legs though others have only 26 Instead of poison fangs they have glands on the sides of their bodies which give off an offensive gas They are usually found under stones or in other dark, moist places Most of them feed on decaying vegetable or animal matter but some attack the roots of garden plants Most American species belong to the genus *Fontaria*

At the CROSSROADS *of the* NEW WORLD

CENTRAL AMERICA Six small republics and a British colony make up Central America, the narrow southern strip of North America between the Caribbean Sea and the Pacific Ocean. Taken together, they are not so large as the Pacific Coast states of California and Oregon, but they have an importance to the United States and to the world far greater than their size would indicate

Extent Greatest length (northwest to southwest) nearly 1 200 miles greatest width mouth of Segovia River to Gulf of Fonseca) about 300 miles narrowest point in Panama) 31 miles Area estimated at about 220 00 square miles Population about 8 900 000

Highlands and Waterways Cordilleran ranges extending entire length of region greatest heights more than 14 000 feet. Highlands *covering three fourths of land area Longest Atlantic coast* river, the Segovia (on Honduras Nicaragua border) 300 miles Pacific coast rivers short and rapid Largest lake Lake Nicaragua about 1 0 miles by 34 miles.

Political Divisions and Capitals—Republics Guatemala (Guatemala City Honduras (Tegucigalpa) El Salvador (San Salvador) Nicaragua Managua) Costa Rica San José , Panama (Panama City) Crown colony British Honduras (Belize)

Chief Exports—Coffee bananas cacao, sugar coconuts chicle, henequen, indigo woods gold hides and skins mother-of pearl shells.

Other Products—Corn beans rice wheat, tobacco cotton tropical fruits and vegetables silver copper iron lead manganese and other mineral resources

Imports Cotton manufactures (textiles and yarn) clothing iron and steel products (machinery) railroad supplies, hardware petroleum products drugs and chemicals wheat flour and other food stuffs boots and shoes.

Lying wholly within the tropics with a rich soil and abundant rainfall, they are a chief source of coffee bananas and other tropical products The forests contain valuable woods such as mahogany rosewood, cedar, and dyewoods. Buried under the soil are gold, silver, and other minerals Because the forest and mineral resources have as yet been little developed the Central American countries are important sources of future wealth

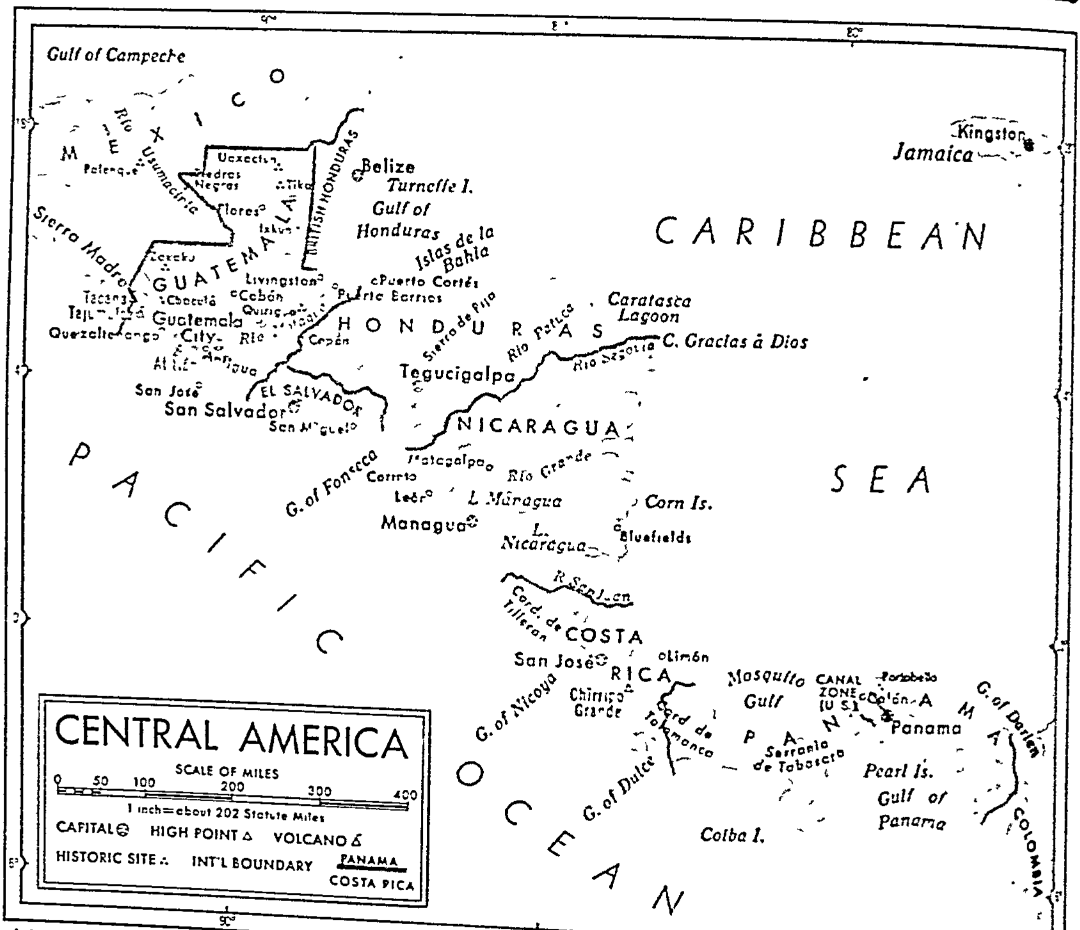
This part of the continent is especially important to the United States for another reason Across it the United States has dug the Panama Canal which is one of the world s busiest sea-lanes Moreover the canal is a vital necessity for the adequate naval defense of the United States because it enables the united strength of the navy to assemble quickly in either the Atlantic Ocean or the Pacific

The Land and the Climate

Central America is a curving strip of land, 30 to 300 miles wide connecting Mexico with South America It stretches over 11 degrees of latitude nearly 1,200 miles, with its southern tip only 7 degrees north of the Equator Its backbone is formed by the great Cordilleran mountain system which extends the length of both the American continents The mountains lie close to the Pacific coast and their north south sweep is broken by ridges which run from east to west These ridges are part of the *Antillean* system which curves east under the Caribbean Sea and sends up peaks to form the Antilles Islands Only in Panama and Nicaragua are the highlands broken by low passes Through the Panama pass in the Panama Canal Zone run the interoceanic Panama railway and canal constructed and owned by the United States In Nicaragua there is a great depression which contains Central America s largest lake Nicaragua Here also are Lake Managua and the San Juan River which flows east from Lake Nicaragua to the Caribbean Sea. Across this lowland the United States has bought the right to build a second interoceanic canal

In the lowlands along the Caribbean coast there is almost no dry season The trade winds which blow from the northeast all the year, drop their moisture as they rise to cross the mountains, bringing heavy rains even in the winter months Some places have 80 to 200 inches of rainfall a year The dampness and the steadily intense heat—averaging about 80 degrees the year round—cause plants to grow luxuriantly

These eastern lowlands are heavily forested except where they have been cleared and drained for banana plantations Along the forest edges are great stretches



A lofty mountain chain, topped by volcanic cones, rises along the Pacific coast of Central America, with spurs running eastward. Hot, rain-drenched lowlands border the Caribbean Sea. Most of the cities are located on the drier Pacific slope.

of dense jungles with matted layers of vegetation. Alligators swarm in the rivers, and the forests have a variety of reptiles and of birds of beautiful hues. Water drips from the trees and the air is heavy like that of a hothouse. Underfoot is a slimy labyrinth of stems and roots. The white man has difficulty in living in such a climate, and even the Indian of the highlands finds it hard to endure. That is why the fruit companies have brought Negroes from the West Indies to work on the banana plantations.

West of the Caribbean lowlands the mountains rise higher and higher. Near the Pacific coast they are topped by a long line of beautiful volcanic cones. Some are more than 13,000 feet high and a number are still active. There is scarcely a city that has not suffered from earthquakes or volcanic eruptions.

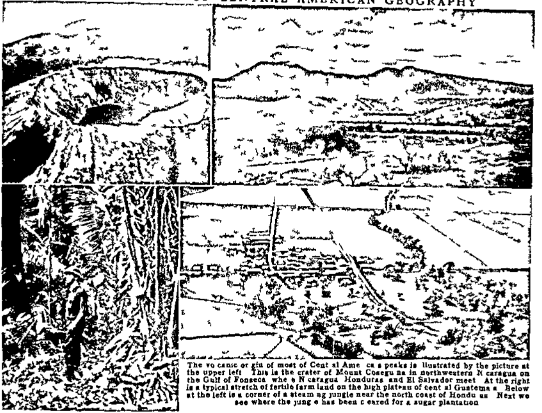
The volcanoes are a blessing as well as a danger, for their lava has produced an extremely fertile and enduring soil on the slopes and in the little mountain valleys. The Pacific coast west of the mountains has a wet season and a dry season, with only about 50 inches of rainfall a year. In the highlands there are delightful coolness, moderate rain, and no mosquitoes. Conditions are excellent for agriculture, and the climate is healthful.

It is not strange, then, that today most of the native people live in the highlands and on the Pacific coast. On the western slopes of the mountains in Guatemala, from 2,000 to 5,000 feet above sea level, are large coffee plantations. There are other coffee plantations on the plateau in Costa Rica, on the western and central uplands of Nicaragua, and throughout El Salvador. These supply the chief money crop of the four countries. The coffee, because of its mild flavor, commands a ready market, especially in Europe. On the lowlands, bananas, sugar cane, and other crops are grown, and there are large stretches of grassland where cattle ranches flourish. Every highland Indian home has its *milpa*, or cornfield, for corn is the staple food of the Indian. Notice on the map that the capitals of all the republics are in the highlands or on the Pacific coast.

The Peoples, Early and Modern

Between about A.D. 320 and the 10th century, a highly advanced group of Mayan Indians established a civilization in the extreme northeastern portion

PICTURE STORY OF CENTRAL AMERICAN GEOGRAPHY



The volcanic origin of most of Central America's peaks is illustrated by the picture at the upper left This is the crater of Mount Coseguina in northwestern Nicaragua on the Gulf of Fonseca where Nicaragua Honduras and El Salvador meet At the right is a typical stretch of fertile farm land on the high plateau of central Guatemala Below at the left is a corner of a steaming jungle near the north coast of Honduras Next we see where the jungle has been cleared for a sugar plantation

of Central America and built splendid stone cities They had a system of writing and an excellent calendar They made pottery wove fine textiles and planted corn and other food plants But long before Columbus landed on the coast of Central America in 1502 they had moved north into the Yucatán Peninsula (*see* Mayas Yucatán)

Meanwhile more primitive tribes moved into the region probably from the south These were the Indians that the Spanish settlers found and enslaved The two races mingled and hence most of the people of Central America today are of mixed Spanish and Indian blood Such persons of mixed blood are called *mestizos* except in Guatemala and El Salvador where they are popularly called *ladinos* There are still large numbers of pure Indians Sixty per cent of the population in Guatemala speak native dialects But there are few people of pure Spanish blood except in Costa Rica Immigration is slight and foreign colonies are small German settlements being the largest

Negroes were imported in colonial days as slaves and later as laborers in regions where white men found it difficult to work Today the Negro population is found almost entirely along the Caribbean coast Very few have moved into the interior Consequently the Negroes have had no great opportunity for intermixture with the native population though in some of the republics they have intermingled with both whites and Indians Honduras has the largest proportion of Negroes and mulattoes

How the Indians Live

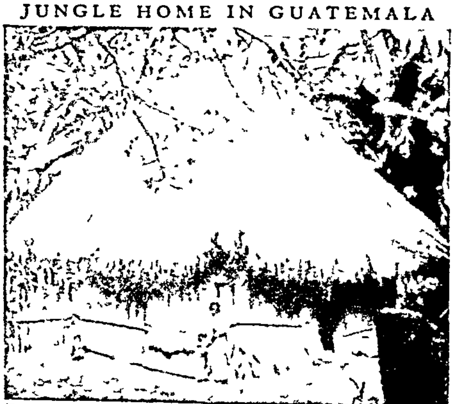
The Indians ways of living are almost as primitive today as when the white man first came They were converted to Christianity and the Roman Catholic church has a strong influence over them But many cling to ancient beliefs and practises They have also kept their various languages or dialects

Most of them live in primitive little villages holding the land in common The village is usually built around a square or park at the head of which stands a large church The houses are huts with dirt floors thatched roofs and adobe or wooden walls The occupants usually sit on the dirt floor A mat thrown on the floor serves as a bed The same mat may be a raincoat by day You see women at their looms weaving cloth for colorful costumes or gay blankets Each tribal village has its special colors and designs You may also see potters working at their wheels or silversmiths hammering out little ornaments

In the highlands the natives grow corn black beans and squash They plant corn by making holes in the earth with a pointed stick The machete and the hoe

are their other farming tools. Ground corn mixed with water is made into flat cakes, called *tortillas*, and baked in a crude oven. This is the Indians' bread. With coffee and beans, it is the staple of their diet. They also grow other crops—rice, wheat, vegetables, sugar cane, potatoes, and cotton; and such fruits as pineapples, mangoes, and papayas. A few tribes in the swampy eastern lands live chiefly by hunting and fishing.

JUNGLE HOME IN GUATEMALA



From forest and swamp come the building materials for this thatched hut. Its floor is the bare earth.

On market day the Indians carry their products into the nearest town to exchange them for other things. On the rough hilly roads you will see them trudging along barefoot, the men carrying sacks on their backs and the women balancing baskets of vegetables or flowers on their heads.

A large proportion of the people of mixed blood live in much the same fashion as the Indians, chiefly because they are too poor to better their living conditions.

The governments of the various republics are making a real effort to improve sanitary conditions and educate the people in health measures. They are waging a battle against hookworm, malaria, typhoid, and other infectious diseases which still cause many deaths. Some of the republics require employers of labor to provide first-aid service for their workers. A pure water supply is available in the capitals and some other cities. The results achieved by the United States in cleaning up the Canal Zone made it possible for white men to live safely in this region (*see* Panama Canal). Similar measures were taken by the United States fruit companies in their banana lands.

Worker and Owner on the Plantations

Most of the peasants—men, women, and children—work on the large plantations. At coffee picking time they move to the big neighboring estates and the villages are almost deserted. Some families have lived for generations on the plantations and have no land of their own. In former days these people were no better off than the serfs on the manors of medieval Europe. They were required to buy their supplies at the plantation store. They were always in debt to the owner and consequently were not free to leave. Today, a laborer may do different kinds of work and go and come as he pleases. But in some of the republics—Guatemala, for example—laws have been passed requiring the Indians to work a certain number of days a year for wages. A work card punched by each employer shows the number of days a man has worked.

The large plantations are owned by a few wealthy citizens or by foreigners. Huge land holdings (*latifundios*) created in colonial days are still held by the descendants of the Spanish colonists. Few plantation owners live on their estates. Most of them prefer the city, where life is more comfortable and varied. Many live in Europe and in the United States, leaving their property in the hands of managers. There are also small farms, owned by descendants of early Spanish colonists, who usually are the leading citizens of the smaller towns.

Town and City Life

The artisans and skilled laborers in the towns are mostly mestizos. Many of this class, which is intermediate between the Indians and the aristocracy, rise to high positions in the government or in the various professions.

The capitals and other large cities are in sharp contrast to the small towns and the Indian villages. They are clean, well laid out, modern cities. The buildings, usually white or in pastel shades, are of Spanish architecture. Because of the frequency of earthquakes, business buildings as well as residences are rarely built more than two stories high. There are good shops, hotels, and cafés, fine public buildings, and beautiful parks. Many of the homes of the wealthy are set in grounds ablaze with gardens of tropical flowers.

Education and Religion

Definite attention is being given to education in all the republics. The percentage of illiteracy in most of them is high, but is decreasing. Several factors make education difficult. The variety of racial make-up is one. A scattered population and poor transportation add to the difficulty. But the chief factor is the lack of sufficient revenue to meet the cost of providing schools for all.

INDIAN WOMAN

From the garden around her jungle home she brings flowers to market.

Education is free and children of primary school age are required to attend school, where educational facilities exist. Primary schools are planned principally for educating the poorer classes. The secondary schools aim chiefly at preparing students for college. All the republics have normal schools and every national capital has a university which provides courses in the professions, the arts, and the sciences.

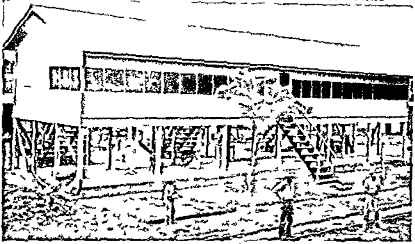
There is freedom of worship in all the republics, but most of the people are Roman Catholics. The

church has always had great influence and *still has, although* it has been separated from the state

Industry and Resources

Agriculture is the only extensive industry The introduction of the coffee plant *soon after the republics* became independent helped greatly to develop their commerce Coffee is the leading source of income in all the states except Panama and Honduras Most of it is raised on *immense plantations*, practically all of which *are owned by Central*

LABOR CAMP ON A BANANA PLANTATION IN *HONDURAS*



This is typical of the homes bu t by the big fruit companies for the native banana workers in Honduras Guatema a and Nicaragua The upper floor is divided into six rooms The open lower floor is screened and serves as a community dining and sitting room. Cooking is done in a separate building

Americans or by German planters A little is also raised on small farms as a cash crop

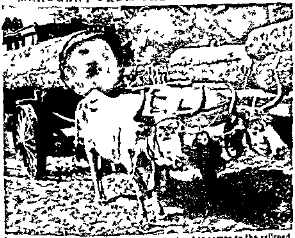
Bananas the other large export crop, are grown chiefly by United States companies There are large foreign-owned plantations in every state except El Salvador Some bananas are grown along the Pacific lowlands on irrigated land, but the Caribbean coast is the great producing region Honduras leads in *shipments The American fruit companies* have built railroads, developed harbors and improved sanitary *conditions* in the areas they *control*

Cattle ranches furnish hides skins and cattle for export Nicaragua and Panama are the chief exporters Some sugar is shipped most of it from El Salvador Guatemala produces chicle from the sapodilla tree for the gum chewers of other lands Cacao, tobacco coconuts mother-of pearl *shell* honey, indigo and henequen are other exports from the various republics Other agricultural products, such as corn, beans, rice wheat, are grown chiefly for home use

Although the lumber industry is little developed several of the republics ship mahogany and other woods Lumbering is the leading activity in the colony of British Honduras which was founded by wood cutters from Jamaica The Peruvian balsam used in *perfumery* and medicines comes from El Salvador Costa Rica supplies balsa wood

In the rugged mountains lies a wealth of minerals which has scarcely been tapped—gold silver, copper, lead, zinc iron antimony manganese, and others Gold and silver mines are the only ones which have been developed to any great extent

MAHOGANY FROM THE GREAT FORESTS



Powerful oxen haul the huge logs from the lumber camps to the railroad which then takes them to Puerto Cortés on the *Gulf of Honduras*.

Foreign Trade

More than half of all Central American trade is with the United States The republics also sell tropical raw materials to European lands Commerce with their Latin neighbors is increasing Small factories turn out such products as cigars and cigarettes soap candles flour shoes cotton goods, and foundry products There are also coffee-drying establishments sugar mills sawmills tanneries, breweries, and distilleries But *most* of the *manufactured* goods that *are* needed—cotton textiles, clothing, machinery, construction *material for roads and railroads*, gasoline, cement, fertilizer, and chemicals—are bought from other countries From the United States come imports of canned goods, hardware, drugs, refrigerators, sewing machines, automobiles, phonographs, and radios

There is little call for the products of the modern factory, and large-scale manufacturing

RAW CHEWING GUM

Chicle, the basis of chewing gum, is the dried juice of the Central American sapodilla tree It starts to market wrapped in palm leaves.

is not likely to be introduced in the near future, both because of the limited market and also because of the lack of coal and other raw materials.

Transportation and Communication

Most of Central America's foreign trade, except in bananas, is carried on through Pacific ports, because the populated plateau area is nearer to the Pacific than to the Caribbean. Also, in pre-railroad days, it was easier to sail around Cape Horn from a Pacific seaport than to cross the wet, hot eastern plain. The first railroads were the shorter Pacific routes carrying the trade of Guatemala, El Salvador, and Nicaragua Only Costa Rica, which has a narrower eastern plain than the other nations, built its first railroad to the Caribbean coast.

Throughout great areas there are no modern means of transportation Railroads and surfaced motor-roads are costly to build and to maintain in this rough country of mountains, jungles, and torrential downpours. Goods are carried over rough and muddy trails by donkeys, mule-drawn or ox-drawn wooden carts with solid wheels, and Indian burden bearers All Central America has only about 2,700 miles of railroads, which is less than two-fifths of the mileage in the state of California. All the republics except Honduras have lines connecting the capitals with their seaports. Honduras has a motor highway from its capital to the north coast Guatemala, Costa Rica, and Panama have lines connecting the east and the west coasts. The chief international line is that between El Salvador and Guatemala; no railroad yet connects all six republics Most of the railways were built by foreign companies, especially the fruit companies, but Central American governments now own some of the mileage Much of the track is narrow-gauge and service is slow.

Road-building is being pushed in all of the republics, especially in El Salvador, Costa Rica, and Nicaragua. With the coöperation of the United States, a motor highway is being built to link the capitals of all the republics with Mexico and the United States. This road, called the Inter-American Highway in Central America, is part of the proposed Pan American Highway (*see* Roads and Streets).

Recent years have seen the development of fir- aviation service by United States companies Air planes carrying both passengers and freight connect all the capitals with one another, and with the United States and South America. There is good and frequent steamship service to the chief ports, but water transportation in some places is handicapped by the shallowness of the harbors. Large vessels have to lie far out at sea, and land their passengers and cargoes in smaller craft.

The larger cities have telephone and telegraph services These services are for the most part owned by the governments, but most of the cable and radio services are American-owned.

The Development of the Republics

Christopher Columbus sailed down the Central American coast on his last voyage in 1502, and founded a colony in Costa Rica. The Spaniard Pedro Arias de Avila conquered Costa Rica in 1513, and the remainder of the region was taken by Hernando Cortez between 1522 and 1525, after his conquest of Mexico By 1570 all Central America, except Panama, was included in the captaincy-general of Guatemala.

When the five provinces of Guatemala colony declared their independence of Spain in 1821, there was no struggle with the mother country, for Spain already had her hands full with the revolt of her more important colonies farther south. After a brief period during which they were allied with Mexico, the Central American provinces formed a federated republic This federation collapsed in 1838, and the five states became independent republics.

THE CAPITOL BUILDING AT SAN SALVADOR

The most densely populated and one of the most progressive of Central American republics is El Salvador. Its capital, San Salvador, nestles among volcanic peaks.

The eastern coast of Nicaragua at this time was virtually a British protectorate known as the Mosquito Coast and Belize had been occupied by British subjects since the 17th century. In 1860 Great Britain surrendered the Mosquito Coast to Nicaragua but it kept Belize, which became known as British Honduras. Panama was a province of New Granada (later Colombia) until 1903 when it declared its independence (*see* Panama, Republic of).

These former Spanish colonies had great handicaps to overcome and their history is marked by unstable governments. The constitutions adopted by all the republics were similar. Each called for a president and a congress elected by popular vote. Of the five original republics, however, only Costa Rica, with its large white population, progressed peacefully. It was the first to establish popular government (*see* Costa Rica). In the other four republics revolutions were frequent, dictators succeeded one another, and constitutions meant little. The United States has stepped in at various times to protect its interests and those of other foreigners and to try to establish order.

The frequently disturbed condition of the republics is explained to a large extent, perhaps, by the organization of society. The feudal system of land holding has produced a class of wealthy land owners and an illiterate peasant class whom the wealthy exploit. There is practically no property-owning middle class, the backbone of democracy. Another handicap to stable progressive government is the character of the country. The division into rugged highlands and hot, wet lowlands has resulted in a scattered population and makes transportation and communication difficult. The intermingling of races has also hampered the development of national unity. Moreover, when the people gained their independence they had had little or no experience in governing themselves, because officials had been sent from Spain. They had no commerce because trade had been permitted only with Spain. And later the interference of neighbors and the commercial rivalries of the great nations, especially Great Britain and the United States, caused difficulties.

ALONG THE TRAIL OF THE CONQUISTADORS

Across the Isthmus of Panama the Spanish conquerors of the New World built the mule trail illustrated in this drawing. Over this trail the treasures of Peru were freighted to Porto Bello on the sea, where the Panama Canal now opens into the Atlantic. At Porto Bello the gold and silver were loaded into galleons bound for Spain.

What of the Future?

Considering their condition when they gained their freedom, all the republics have made progress and are continuing to do so, but it is uphill work. They have built up their foreign trade, but this has depended mainly on the world demand for one product—coffee. Not only internal conditions, therefore—such as revolutions and volcanic eruptions that have laid waste plantations—but wars and economic depressions in other countries have vitally affected their welfare. Foreign capital has helped to develop the countries but their domestic financial condition is poor and they have been unable to meet interest payments on foreign loans. From time to time attempts have been made to reunite the republics in the hope that they might work together to develop the region and diversify its industries. So far, however, advocates of a new federation have made little headway.

The United States has important interests in Central America, both economic and strategic. The relations of the Central American nations with the United States and additional aspects of their culture are discussed in the article Latin America. (*See also*

Latin American Literature and the separate articles on the several republics and the Panama Canal. For Reference-Outline, *see* North America; *see also* **Central America** in FACT-INDEX at the end of this volume).

CENTRIFUGAL FORCE. When you whirl a stone on the end of a string, you feel the stone trying to pull away. That pull is called *centrifugal force*, which means a force that "flies out from the center." It is created by the simple physical law that all moving objects, if left to themselves, will keep on moving *in a straight line*, and when we make them move in a curve, they resist the change of direction (*see* Mechanics).

The amount of this resistance depends upon three things—the weight or mass of the object, its speed, and how sharply the direction is changed. If the stone is heavy enough or you whirl it fast enough, the string will break. Whereupon the stone will fly off—not on a line directly away from the center, but at right angles to that line—in other words, at a tangent to the circle in which it was moving before the string broke.

Every day we meet dozens of other examples of centrifugal force. When an automobile makes a sharp turn, the passengers sway over in the direction in which they were going before the turn started. If the turn is made too fast the car will tip over, and it will always tip toward the outside of the curve. Highways intended for fast traffic have banked curves, sloping up toward the outside, to offset centrifugal force.

THE ULTRA-CENTRIFUGE

The text tells how the device works. The top, with its observation window, is lifted to show the interior. At the right is a separate view of the rotor.

Balanced by Centripetal Force

The physicist, who deals with the balance of forces in nature, gives the name *centripetal* ("center-seeking") to any force that offsets centrifugal force. Thus, your own pull on the string that prevents the whirling stone from flying away is an example of centripetal force. The inward tip that the banked curve gives the turning car is another example.

In rotating machinery the centripetal force lies in the strength of the whirling metal—the force that holds it together in spite of the tendency to fly apart. Those who design fly-wheels and grinding wheels must make sure that the reserve of centripetal force is greater under all normal conditions than the centrifugal force. Large fly-wheels sometimes break apart and kill people or wreck the buildings in which they are housed because they have been driven faster than they should have been. Grinding wheels often injure workmen who run them too fast or apply too much side pressure to them.

The commonest example of making centrifugal force do useful work is found in the cream separator. A drum full of milk rotates rapidly; the skim milk, being heavier, flies to the outside of the drum while the lighter cream stays nearer the axis (*see* Dairying).

In the practise of medicine and in the study of biology and chemistry, devices called *centrifuges* are used to separate blood cells from blood serum, bacteria from liquids, and for many other purposes. In the simplest centrifuge, a test-tube full of the liquid to be "separated" is put in a hinged holder on each end of a rotating bar or "rotor." A high-gear hand-crank or an electric motor revolves the bar, so that the test-tubes fly out horizontally and the heavier particles are driven to the bottom of the tubes. When the machine is stopped, the heavier and the lighter parts of the material remain separate long enough for the operator to collect whichever part he requires. Large centrifugal machines are used in sugar making (*see* Sugar), as hydro-extractors in laundries (*see* Laundry), and in many other industries.

A triumph of modern technology is the *ultra-centrifuge* shown on this page. Professor The Svedberg of the University of Uppsala, Sweden, received a Nobel prize in 1926 for his experiments with a device of this type. The 7-inch rotor, driven by an oil turbine, revolves in a vacuum 60,000 times or more a minute. This creates an outward-moving force 250,000 times as great as the force of gravity. This is sufficient to separate, according to their relative weight, the molecules contained in a liquid—a feat never before accomplished because the activity of molecules in liquids tends to keep them evenly mixed.

The liquid to be examined is placed in a glass container near the rim of the rotor. It is illuminated by a stroboscopic light—a glow lamp that is lighted for a tiny fraction of a second each time the whirling container passes the window in the front of the apparatus. In spite of its terrific speed, the container under this kind of lighting has the appearance of standing still and the behavior of the substances it contains may be watched through a microscope or may be photographed. The case of the machine is made of 5-inch steel to guard against injury to the operator if the rotor should fly apart.

The following formula is used in computing centrifugal force: $F=\frac{mv^2}{r}$, where m is the mass of the object or portion of the object exerting the force, v is its velocity, and r is the radius of the curve of its motion.

The HARD LIFE *of* SPAIN'S GREATEST WRITER

CERVANTES SAAVEDRA (sėr-văn tez sä-ä-vä drä) MIGUEL DE (1547 1616) There is a story that King Philip III of Spain looking out of his palace window one day saw a man reading a book by the road side The man was laughing so heartily that tears flowed down his cheeks That man said the King is either crazy or he is reading Don Quixote Whether true or not this story serves to give us an idea of the immediate and tremendous success that Cervantes scored with his masterpiece Six editions were called for in the first year after the publication of the first part (1605) and translations into foreign languages were begun almost immediately Ever since it has ranked with the most popular books ever written It has been translated into every important language

THE AUTHOR OF DON QUIXOTE

Cervantes was in his own words of aquiline countenance with chestnut hair a b owsmoo h and high, bright eyes and a hooked nose He further tel s us that he was neither la ge no small, bowed of shou der and none too light on his feet Th s pi ure s f om Tomás Life (Houghton

The career of Miguel de Cervantes was in striking contrast to the fate of his great book It was one long struggle against poverty debt and sheer bad luck Little is known of his first 20 years He was born in the town of Alcalá de Henares in the autumn of 1547 the fourth child in a family of six children His father Rodrigo de Cervantes was a poor and obscure surgeon There is no evidence that Miguel attended the university of his native town or any other of the towns in which he spent his youth—Valladolid Seville and Madrid

By the end of 1569 when he was 22 Cervantes was in Rome where for a time he served as a gentleman in waiting in the household of Cardinal Acquaviva The following year he enlisted in the Spanish militia then on duty in Italy From *1570 to 1575* he took part in various military activities One of these was the battle of Lepanto (October 1571) a famous sea fight in which the allied fleets of Spain and the Italian cities destroyed the Turkish fleet In this battle Cervantes suffered three gunshot wounds one of which permanently crippled his left hand— for the greater glory of the right as he jestingly said

Captured by Pirates and Sold into Slavery

Four years later the ship on which Cervantes was returning on leave of absence to Spain was captured by Barbary pirates He and his brother were carried as slaves to Algiers When the ransom sent by their parents proved insufficient to free both Miguel insisted that his brother be *freed Later when an attempt* at escape failed he took all the blame that his comrades might go unpunished The *viceroy of Algiers* struck by his bravery bought *him from his master*

After five years of slavery Cervantes was at last ransomed by his relatives and friends On *his return* to Spain at 33 he found himself without a job With a maimed hand he could not return to soldiering and the King turned a deaf ear to his requests for an appointment so he tried his hand at writing plays In the next few years he turned out 20 or 30 plays as well as a pastoral romance Galatea But they were all failures more or less and convinced Cervantes that he could never earn his bread by writing Meanwhile his father had died and Cervantes had married a girl who brought him a small dowry

In Government Service

In time his efforts to get a government post succeeded By 1587 he was again in the service of the King this time as an agent to collect wheat barley and oil for the Invincible Armada which went down to defeat the next year before the sea hawks of England (*see* Armada Spanish) In this and like capacities he served the King for several years though he still suffered poverty because his pay was far in arrears Tangled accounts led to financial difficulties and he was imprisoned more than once for debt

Don Quixote was begun it seems likely while Cervantes was in jail The law had clapped down on him in 1597 for a shortage in his accounts as tax collector caused by the failure of the banker to whom he had entrusted the money Cervantes was held responsible and was thrown into prison for a few months when he could not pay Apparently he was jailed again about 1603 but nothing certain is known about his life during these years until he appeared at Valladolid in 1604 with the manuscript of the first part of 'Don Quixote

Famous but Poor

This was published in 1605 when Cervantes was 57 Although it was hugely successful he got little money out of it for it was pirated right and left Through

his last years, the fame of 'Don Quixote' resounded through all Europe. But Cervantes lived in poverty, dependent on rich patrons. He published the second part of 'Don Quixote' in 1615, and died a year later on April 23, ten days before the death of Shakespeare. (This date is according to our New Style or Gregorian calendar. According to the Old Style or Julian calendar, Shakespeare also died on April 23. By our calendar, Shakespeare died on May 3, 1616.)

In the face of all his hardships, Cervantes remained cheerful to the end. Shortly before he died, he wrote: "Good-by, pleasant fancies; good-by, merry friends, for I perceive that I am dying. My wish is to see you happy in the other life." Like Don Quixote, Cervantes himself remains a beloved figure in literature.

Best Editions of Don Quixote

Don Quixote of the Mancha, retold by Judge Parry, illustrated by Walter Crane (Dodd, 1911).
Don Quixote, 2v. (Dutton, n d) (Everyman's Library)
Don Quixote; adapted by E G. Rich (Houghton, 1935).
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CEYLON. Beauty and richness of soil have won the name "Pearl of the Orient" for this island dominion of the British Commonwealth. Ceylon is about the size of West Virginia, having an area of more than 25,000 square miles. A channel only 22 miles at its narrowest point separates it from India.

Rolling plains cut by long, narrow ridges cover most of the island. These rise toward mountains in the south. "Adam's Peak," from which Buddha is said to have ascended to heaven, is visible from far out at sea. The tropical vegetation includes tall tree ferns, scarlet-flowering rhododendrons, towering palms, and valuable ebony and satinwood trees. Where the jungle has been cleared and the land drained, the climate is healthful. Annual rainfall varies from 40 inches in the north to 200 inches in the southwest.

Agriculture is the chief occupation, and most of the people live in small farming communities. A few factories produce leather goods, plywood, glass, paper, and chemicals. In 1949 construction was begun on a huge dam to harness the waters of the Gal Oya ("Small Rock River"). The project includes irrigation for rice and sugar plantations and electric power for small factories in the farm villages.

Ceylon ranks second among tea-producing countries and exports hundreds of millions of pounds annually. Other important agricultural products are rubber, coconut products, cinnamon, cacao, and citronella oil. The principal food of the people is rice. Much of the supply is grown on the island, but every year some rice must be imported to supplement the home crop. The farmers also raise goats and horned cattle. Trained elephants do much of the work in the forests.

The most important mineral product is graphite, from which lead pencils are made. The gem stones of Ceylon are famous and include moonstones, garnets, topazes, amethysts, sapphires, and rubies. Mica deposits are being worked. The pearl fisheries have been noted for nearly 2,000 years.

About two-thirds of the people are Sinhalese or Ceylonese, who came from northern India about 500 B.C. In their traditional costumes the men look much like the women, for they wear skirts and hold back their long hair with tortoise-shell combs. Other races include Tamils (from southern India), Moors, and Malays. A few Veddahs, supposed to be the original inhabitants, still live a primitive life in the forests. Buddhism has been the prevailing religion since the 3d century B.C., but the Hindu and Mohammedan faiths also have many followers. Christianity has made progress in recent years.

In the north of Ceylon ruined cities give evidence of a splendid ancient civilization. Excavations have brought to light great palaces and temples and extensive irrigation systems. What is called "the oldest historical tree in the world" grows at Anuradhapura, the ancient capital. It was planted in 245 B.C. as a cutting from the famous Bo tree of India, under which Gotama (Buddha) is said to have received the inspiration to found the Buddhist religion.

In Europe little was known of the island until the 16th century, when adventurous Portuguese seafarers and colonists planted settlements there. The Portuguese were driven out between 1638 and 1658 by the Dutch. The British ousted the Dutch in 1796 and annexed Ceylon to the presidency of Madras. In 1802 it was separated from India and made a crown colony of Britain. The Ceylonese were allowed to share in the government after 1931. On Feb. 4, 1948, Ceylon peacefully achieved complete self-rule as a dominion in the British Commonwealth. Population (1953 census, preliminary), 8,103,648. The capital and chief city is Colombo (population, 424,816).

CÉZANNE, PAUL (1839–1906). Today many critics call Paul Cézanne "the father of modern painting." But during most of his life he seemed to be a failure. Scarcely anyone liked his paintings. He sold no pictures, won no prizes, and had to be supported by his father and by Émile Zola, his boyhood friend. Only after his death was Cézanne acclaimed one of the greatest masters of the 19th century.

Cézanne was born in Aix-en-Provence, France, on Jan. 19, 1839. His father, Louis Auguste, was a hatter who became a successful banker. As a child Paul was temperamental and nervous; the slightest criti-

PAUL CEZANNE

Here Cézanne pauses in his studio before an unfinished landscape and figure study

cism enraged him But his family understood him and he spent happy days wandering through the Provence forests with young Zola and other friends

He received a classical education at the College Bourbon and studied drawing at the Aix museum After brief sessions at law school and in his father s bank, he went to Paris to study painting Restless he returned often to Aix He worked many summers painting landscapes near his father s suburban home

During the Franco Prussian War in 1870 Cézanne fled to Estaque near Marseilles to avoid conscription With him went Hortense Fiquet In 1872 their son Paul was born Fearing disinheritance if his father learned about the child Cézanne postponed formal marriage until Louis Auguste died in 1886

Hortense sat as model for many of Cézanne s portraits This was a real ordeal for he was exasperatingly slow After his friend Ambroise Vollard sat 115 times for a single picture Cézanne said I am not entirely displeased with the shirtfront

Homely and powerful in body Cézanne looked like a stolid peasant He became shy and preferred to live alone Often in anger he slashed his paintings

Cézanne was an old man before even fellow painters realized his worth He had to beg salon officials to display his pictures Undiscouraged he painted until a week before his death on Oct 22 1906

Most 20th-century painters have been influenced by Cézanne He abandoned perspective and used overlapping planes to give objects depth He invented a way of modeling three-dimensional forms by painting in patches of color—warm color for advancing planes cool color for receding planes He painted from nature but did not hesitate to distort a shape or to change its color to convey its psychological effect or to fulfill the needs of his composition His finest works are serene but powerful expressions of forms in space with vibrant color (*See* Painting)

CHAIN STORES A large part of the retail business of the United States is done by vast networks of chain stores Many stretch from coast to coast Others serve a city or a region A chain is simply two or more stores centrally owned and operated However the Bureau of the Census classifies 11 or more stores as being more typically a chain

About 1 500 chain store companies operate some 82 000 individual stores This is 5 per cent of all retail stores in the United States but they handle about 20 per cent of all retail sales They account for a much larger part of the sales of department, variety shoe dry goods grocery automobile supply, dairy products liquor and candy stores Grocery chains have the largest sales of all chain stores

The idea of a chain of stores is very old In 200 B C On Lo Kass operated one in China The oldest chain in America is the Hudson s Bay Company chartered in 1670 in Canada (*see* Hudson s Bay Company)

Modern chain stores began in 1859 when George F Gilman and George H Hartford founded the Great Atlantic and Pacific Tea Company (A & P) as tea stores in New York City This is the world s largest retail chain with about 5 000 grocery stores Other great grocery chains are the Kroger Company and the Safeway Stores Frank W Woolworth began the first variety chain store in 1879 at Lancaster Pa He had noticed how the sign 'Anything on this table 5¢" quickly sold his dry goods Woolworth 5-and 10-cent stores number about 2 000 The S S Kresge Company is the next largest dime-store chain

Other large chains are Walgreen Company (drugs), Melville Shoe Corporation (shoes) J C Penney Company (apparel) Western Auto Supply Company (automobile supplies) and John R Thompson Company (restaurants) The Sears Roebuck and Company mail-order house opened retail stores and is now the world s second largest retail organization

Chain stores are successful because they sell large quantities of goods at lower prices by buying large amounts for less They have a quick turnover of stock at a minimum profit per unit Besides operating warehouses they often manufacture their merchandise Most chains have a cash and-carry policy They employ many kinds of specialists Chain stores are clean and well equipped They attractively display fresh stocks in wide assortments They are located in busy shopping centers The chains advertise effectively, dividing the cost among all the stores

The chain system however has limitations too Some customers want credit and delivery Some find chain merchandise limited and of average quality Others prefer the personal service of the independent storekeeper Chains sometimes find the cost of management high and trained personnel unavailable

Early Opposition to Chain Stores

The rapid growth of chain stores antagonized retailers wholesalers and manufacturers in the 1920 s They claimed that chain stores paid insufficient taxes and took money out of town They argued that chains did not support community enterprises They felt that chains were monopolies and reduced opportunities for going into business They charged that chains sold inferior merchandise short-weighted and short-changed patrons and paid low wages They objected to suppliers

giving chains excessive discounts and allowances. Finally, they argued that chains are unfair in using loss leaders sold below cost to attract trade.

Many states imposed special taxes on chains according to the number of stores operated. The Robinson-Patman Act of 1936 outlawed price discrimination on quantity sales. Congress also supplemented the states' fair trade laws that regulated price cutting with the Miller-Tydings Act of 1937 (declared unconstitutional in 1951) and the McGuire Act of 1952.

Chain Stores Important Today

Chain stores have won great public acceptance. Independent merchants still have a high business mortality, primarily because of a lack of experience and capital. They have met the competition of the chains by improving efficiency. Many have also joined *voluntary chains*, or *co-operative groups*. These merchants own their stores, but buy, advertise, and control store operations co-operatively. More commonly they affiliate with the voluntary chain of a wholesaler. The largest among food stores are the Independent Grocers' Alliance (IGA) and the Red and White Stores. Butler Brothers sponsors the Federated Stores, a large drygoods chain; and the Ben Franklin Stores, a big variety chain. Many gasoline companies now give franchises to independent filling stations.

Today the chains have fewer but larger stores, each with greater sales. Many grocery chain stores are *supermarkets*—large self-service stores with several departments. Clarence Saunders of Memphis originated self-service in his Piggly-Wiggly stores in 1916. Air conditioning, fluorescent lights, and ample parking are common features. Shoppers select frozen foods and meats from open refrigerated cases and prepackaged products from mass displays and wheel them in carts to check-out counters. Other types of retail stores have adopted self-service. Chain stores have led in the trend toward suburban shopping centers.

Many countries, including England, France, Italy, Germany, Scandinavia, and Japan, have chain stores. Many American chains have foreign branches.

CHALK. In crayon form, the abundant mineral called chalk is a familiar classroom tool. Its softness and smoothness make it excellent for writing on blackboards. It also has many uses in industry.

Chalk is a limestone, made up of microscopic shells of calcium carbonate (*see* Limestone). These shells belonged mostly to tiny sea creatures called *foraminifera*. They died ages ago during the Cretaceous period, which is named from the Latin word for chalk, *creta* (*see* Geology). Their shells sank to the sea bottom and then were compressed into a soft rock. Earth disturbances later elevated this chalk. In warm seas, the process of making chalk is still going on.

Vast beds of chalk underlie areas of England, and cliffs of chalk border its south coast. Huge quantities are quarried there and in France, Belgium, and Denmark. The United States has little chalk. Deposits of slight value are found in Alabama, Texas, Kansas, and other states. Pure deposits are white or gray white; those with clay or sand are gray or buff.

High-grade blackboard crayons contain at least 95 per cent refined chalk mixed with a binding substance. Poorer grades are adulterated with clay. "Soft" crayons, often called "chalk," are molded from gypsum (*see* Gypsum). Colored crayons contain pigments.

Chalk that has been pulverized, washed, and filtered is called whiting. It is used to make many products, such as calcimine, putty, paints, medicines, rubber, tires, paper, ink, and tooth pastes and powders. Crude chalk is used largely in making cement (*see* Cement). French chalk is a form of talc (*see* Talc).

CHAMBERLAIN, JOSEPH (1836–1914). "Old Joe" Chamberlain, as his followers called him, rejected the highest office in Great Britain rather than change his ideas. During 30 years of public life he was one of the best loved and most hated men in England.

Like generations of Chamberlains before him, he was destined for a business career. When he was 18, his father, a London manufacturer, sent him to Birmingham, the family home, to manage a screw factory.

Twenty years in business gave Chamberlain a fortune on which to retire. His zeal for social reform, however, led him to politics. In 1873 he became mayor of Birmingham. As one of the first apostles of city reform, he built parks, cleared slums, and achieved municipal ownership of the gas and water supply.

In 1876 Chamberlain entered Parliament as a representative from Birmingham and a member of the radical wing of Gladstone's Liberal party. His keen, biting wit made him a formidable opponent.

He emerged as leader of the radicals. In 1880 he entered Gladstone's cabinet as president of the Board of Trade. He sponsored legislation in favor of the working classes. In 1886 he resigned from the cabinet in disagreement with the government's policy of Home Rule for Ireland. By forming the Liberal Unionist party he weakened the Liberals.

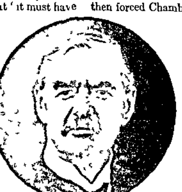
In 1888, weary of parliamentary struggles, he took a trip to the United States to negotiate a fisheries dispute. There he met Mary Endicott, daughter of President Cleveland's secretary of war, and she became the third wife of the twice-widowed statesman.

Chamberlain became a firm friend of the United States and a strong believer in imperialism. As colonial secretary (1895–1903), he was criticized for not averting the Boer War. He worked for an alliance between England, Germany, and the United States, but failed because of the kaiser's refusal to accept British naval supremacy. So convinced was Chamberlain that England must "think imperially," that in 1903 he advocated tariff reform giving preference to the colonies, as opposed to the traditional English doctrine of free trade. When his policy was not adopted, he resigned. Thus he cast away his chance to be prime minister and split the Liberal Unionist party. As a result the party suffered a crushing defeat in 1906, although Chamberlain was re-elected.

Joseph Chamberlain's sons achieved higher office than their more forceful father. Austen, Joseph's son by his first wife, became foreign secretary; Neville, his son by his second wife, became prime min-

later. In his last years the old man relied on Austen to continue the battles he was now too weary to fight Shortly after Birmingham had given "Old Joe" a great celebration in honor of his seventieth birthday, he suffered a stroke that kept him an invalid for the eight remaining years of his life

SIR (JOSEPH) AUSTEN CHAMBERLAIN (1863–1937), son of Joseph and half-brother of Neville Chamberlain, was trained for politics Of his first speech in Parliament in 1893 Gladstone said that ' it must have been dear . to a father's heart." Austen believed, like his father in the combination of imperialism and social reform He held many Cabinet posts and was a leader of the Conservative party As foreign secretary, from 1924 to 1929, he sought for peace through disarmament and negotiated the Locarno Pact of 1925 For this he shared the Nobel peace prize with Charles G Dawes of the United States (*See also* Chamberlain, Arthur Neville)


NEVILLE CHAMBERLAIN

CHAMBERLAIN, (ARTHUR) NEVILLE (1869–1940) If you had asked Joseph Chamberlain which of his two sons was more likely to be prime minister of England, he would have answered without hesitation Austen Yet it was Neville Chamberlain the prosaic businessman, who rose to the position his brilliant father and his half-brother sought but never attained

From the first Neville was chosen to run the family business After his education at Rugby and at Mason College in Birmingham, his father sent him to the Bahama Islands, where he spent seven years as manager of a plantation He returned to Birmingham in 1898 and in ten years became prosperous

Like seven members of his family before him Neville entered politics as mayor of Birmingham He was elected to Parliament from Birmingham in 1918 and soon rose to prominence in the Conservative party In 1924 he became minister of health and held this position with but a single interruption until 1929 In 1931 he became chancellor of the exchequer and in this post he achieved his father's unrealized dream of establishing a protective tariff

In 1937 Stanley Baldwin resigned and Neville Chamberlain, almost 70 years of age, became prime minister in one of England's most troubled periods His critics maintained that his training as a business and financial expert little qualified him for the intricate problems of foreign affairs that he had to face

Hitler, having militarized Germany, was demanding "living space" for the German people His first objective was to bring into the German state the Germans living in Austria and in the western (Sudeten) territories of Czechoslovakia Chamberlain believed that if Hitler and Mussolini were granted reasonable concessions they would settle down peaceably This policy became known as "appeasement '

In September 1938 Chamberlain visited Germany for conferences with Hitler and Mussolini to try to make a peaceful settlement between Germany and Czechoslovakia On September 29 Britain, France, Germany, and Italy signed the famous Munich pact, which ceded to Germany the Czechoslovakian Sudetenland Chamberlain believed the agreement meant "peace in our time " Hitler, however, seized the rest of Czechoslovakia in March 1939 Public opinion then forced Chamberlain to reverse his policy.

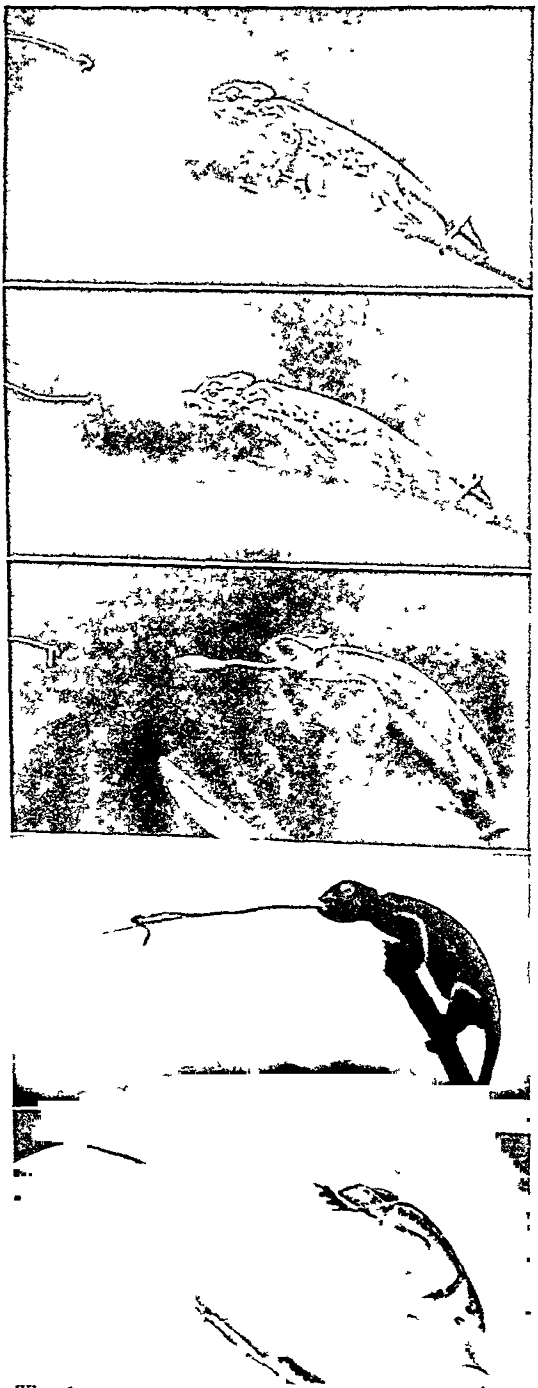
In April 1939 he pledged that England would defend the independence of Poland, Rumania, Greece and Turkey When Germany, defying the British guarantee, invaded Poland, Chamberlain on September 3 led his country into war As he made his historic declaration of war in the House of Commons Chamberlain in a weary and trembling voice said "Everything that I have worked for and believed in during my public life has crashed in ruins "

As war leader, Chamberlain became the target of bitter attacks The press members of Parliament and the people clamored for a leader who had not been identified with the appeasers On May 10 1940, he resigned For a time he served in the Cabinet of his successor Winston Churchill but his health failed rapidly and on Nov 9, 1940, he died (*See also* English History)

CHAMELEON (*ka-mē'lē-ŭn*) The chameleon is the world's champion turncoat One moment it is brilliant green, the next it may be gray black or chestnut and black, or covered with yellow spots This is nature's way of protecting this sluggish little lizard which moves so slowly If it did not have the power of taking on the color of its surroundings and so making itself almost invisible, it would soon be exterminated by snakes and birds which prey upon it The color changes are accomplished by layers of cells beneath its transparent skin containing yellow, black, and red coloring matter These cells are under the control of the nervous system, and by contracting and expanding they produce changes in coloration

Even without this power the chameleon would be one of the most extraordinary of animals Its great protruding eyes are entirely covered with eyelids except for a tiny round hole, and the lids move with the constantly rolling eyes What is still more amazing, the chameleon can roll its eyes independently in any direction, so that one eye may be looking at a fly in front of it, while the other keeps watch over the animal's shoulder As another compensation for its slowness, the chameleon has a tongue half the length of its body, which can shoot out like a flash to catch unwary insects with its sticky end

HOW THE CHAMELEON CATCHES ITS MEALS



When hungry, the chameleon "lies low" with its color adjusted to its surroundings. When an insect passes by, the chameleon shoots out its long tongue, striking its prey with the skill of a trained marksman. The insect is glued to the tip of the sticky tongue and is drawn back and swallowed. A motion-picture camera caught the views above.

The true chameleons, of which there are more than 50 species, are found only in Africa and a few other parts of the Old World. The best-known species has a body about six inches long and a tail nearly as long again, with which it clings to twigs. The so-called American chameleon belongs to a quite distinct branch of the lizard family, the *Iguanidae*. It is smaller and more active than its Old World namesake, but has the same remarkable property of changing color.

Scientific name of common chameleon, *Chameleon vulgaris*, of American chameleon, *Anolis carolinensis*

CHAMOIS (*chăm'ĭ* or *shȧ-mwä'*). "Nimble as a chamois," we often say when we speak of some feat of agility, for this small goat-like antelope of the mountains of middle and southern Europe is one of the fleetest and most active of creatures. When alarmed it will flee to the most inaccessible places by a series of prodigious leaps, across chasms and up or down the face of almost perpendicular cliffs. The sole of its hoof is slightly depressed below the outer margin, thus enabling it to get a foothold on the slightest projection.

Chamois live in herds of 20 or 30 and their senses are so acute that they are among the hardest of animals to hunt. When feeding they post a sentinel, who warns of the approach of danger by stamping and making a whistling noise. Chamois-hunting used to be a favorite pursuit in the Swiss Alps, but the animal is now rare and is protected by law.

It dislikes warm weather, ascending in summer to the regions of perpetual snow and only coming down to the forests in winter. Under its coat of coarse reddish-brown hair a thick under-fur grows in the winter time. Its slender body is about three feet long, and two and a half feet high at the shoulders, with a short black tail. From the forehead rises almost vertically a pair of slender black horns six to eight inches long, which hook back at the top.

The fine soft leather known as "shammy" was originally made from chamois skin, though most of the skins now sold under that name are sheepskin.

Scientific name, *Rupicapra tragus*. The chamois is the only species of its genus and is readily distinguished from all other ruminants by its vertical backwardly hooked black horns, which are common to male and female, although smaller in the latter.

CHAMPLAIN', SAMUEL DE (1567?–1635). The "Father of New France" was Samuel de Champlain. He founded Quebec, the first permanent French settlement in America, and kept the struggling community alive during its early years. He explored Canada as far west as Lake Huron and discovered the lake that bears his name, Lake Champlain.

This bold leader was born about 1567 in Brouage, a small French seaport on the Bay of Biscay. His father was a sea captain, and young Samuel was well trained in seamanship, navigation, and map making. In 1589 Champlain joined the forces of Henry of Navarre in the religious war between the Catholics and the Protestants (called Huguenots) of France.

Henry won the war and became King Henry IV in 1589 Champlain was engaged by Spain to command a ship sailing to the West Indies and Mexico After he returned he made a full report to Henry This was the first real information the French had about the Spanish possessions For this service Champlain was granted the title of sieur

King Henry decided to establish French settlements in Canada To do so he named a patron (a responsible financier or promoter) of the selected region who agreed to establish colonies In return the patron received a monopoly of trade with the region In 1603 Champlain went as royal geographer with an expedition sent to find sites for settlements and trade Next year he returned with a group of colonists They built dwellings and a storehouse on Dochet Island near the mouth of the St Croix River in New Brunswick The settlers lived through a fearful winter To get fresh water they had to melt snow Vegetables froze and many men contracted scurvy In the spring they moved to a better site on Nova Scotia But no supplies came from France so they abandoned the colony in 1607 During this time Champlain explored the coast as far south as Cape Cod

In 1608 Champlain was sent as lieutenant general of another expedition He founded Quebec and made friends of the Huron Indians of the region In 1609 he went with the Hurons to fight the Iroquois in New York He discovered Lake Champlain and near it on July 30 he terrified and routed the enemy with gunfire Thereafter the Iroquois were bitter enemies of the French (see Canadian History)

Champlain then made several exploring trips seeking rivers that might lead to the Pacific Ocean In 1615 he reached Georgian Bay and Lake Huron After 1616 he acted as leader in Quebec for a succession of patrons and visited France often seeking help

In 1627 Cardinal Richelieu formed a company to send settlers to New France This brought hope to the colony But in 1629 the British seized Quebec and held it three years Champlain waited in Europe After peace was signed he returned as governor He died Dec 25 1635

Chancellorsville Battle of At Chancellorsville Va on May 2 and 3 1863 the Confederates gained one of their greatest victories in the Civil War The Union army though superior in numbers after three days terrible fighting was defeated and retreated across the Rappahannock with a loss of 18 000 men The Confederate loss was only 13 000 but it included the brave and able Stonewall Jackson who was accidentally shot by his own men and died eight days later (*See* Civil War American)

A FAMOUS CASTLE OF THE CHANNEL ISLANDS

Elizabeth Castle at St Helier capital of Jersey dates from 1551 At high tide it can be reached only by boat since it is built on a rocky island Charles II lived here for some years before he was proclaimed king

Channel Islands When you see the beautiful fawn-colored Jersey cows or the handsome Guernseys with their white markings think of the Channel Islands for it is to these tiny British possessions off the coast of France that we owe two of our most famous breeds of dairy cattle

The islands from which these breeds come—Jersey and Guernsey—with the addition of Alderney Sark and a few tiny islets have a total area of only 75 square miles about the size of the city of Cincinnati But every available acre is under cultivation or used for pasturage and the soil produces so abundantly in the delightfully mild climate that immense quantities of vegetables fruits flowers and dairy products are shipped to England about 100 miles away

Visiting these islands is like sailing back into the enchanted land of yesterday for few places in the world have retained so many of the customs and laws of the Middle Ages The ancient charters framed nearly a thousand years ago by the dukes of Normandy still remain largely in force and much of the land is held under the same old system of tenure that existed in feudal days One tenant for instance still owes his landlord one donkey every year and a cake made from a bushel of wheat Another is required to pay 18 eels (or the money equivalent) another a chicken with a tail at least one inch long

These and many other curious survivals testify to the days when the Channel Islands were a part of ancient Normandy whose ruler William the Conqueror became master of England The farmers still speak the old Norman French and French is the official language of the courts and the local assembly The islands are in most respects self governing and have their own copper coinage They are administered by lieutenant governors sent from England The people have stubbornly refused to submit to a system of import duties

These sunny islands are popular tourist resorts Snow and frost are practically unknown Sailing and swimming are popular sports During the second World War the Germans occupied the islands from June 30 1940 until May 9 1945 Many islanders were sent to Germany for forced labor Population (1951 census preliminary) *102 776*

CHARADE (*sha-rād'*). The charade is a guessing game based on words. A person, or a team, secretly selects a word of two or more syllables and then gives the meaning of each syllable by talk or pantomime or by acting out a scene. The people who do not know the secret word must guess the meaning. *Metaphysician,* for example, could be represented by two people meeting, one saying, "Good morning, Doctor." ("Met a physician.") Such words as *ingratiate* ("in gray she ate") are good puzzlers.

Many words can be presented in two or more scenes. Announce the word *innkeeper,* for example, as "A noun, common, singular, three syllables, two scenes." In the first scene speak and act the word *in,* making such remarks as: "What have you *in* your pocket?" "Look *in* a book." In the second scene, team members pretend to be animals, such as roaring lions, growling bears, snarling hyenas—with an animal *keeper* obviously "keeping" them. If the word still cannot be guessed, arrange a third scene to use the whole word innkeeper in the dialogue.

CHARCOAL. The porous, black, brittle substance left when wood or bones are partially burned or charred is called charcoal. It is an impure variety of carbon, which has the important property of being able to adsorb enormous quantities of gases.

Animal charcoal, or bone black, is made by heating bones in a closed vessel, thus driving off gases, water vapor, and oil. It is seen usually in coarse grains from the size of peas to pinheads and is used to destroy disagreeable odors and to remove color from liquids. For example, syrup of sugar is allowed to drip through a layer of bone black. The charcoal holds all color particles and the syrup comes out clear and free of discoloration. Another animal charcoal is obtained by burning blood.

Wood charcoal is the most important variety. Wood consists chiefly of carbon, hydrogen, and oxygen. When it burns in the open air, it leaves only a small quantity of white ash. If the air is partially cut off, only the volatile matter burns, leaving the carbon The old method of making charcoal took place in charcoal pits. Billets of wood were piled on end in rows in a large conelike heap. This was covered with turf or with moistened ashes, and holes were left at the bottom for air to enter and at the top for a chimney. The wood burned slowly. When fully burned, the heap was covered and left to cool for two or three days. By this method 100 parts of wood produced about 20 parts by weight of charcoal. The modern method is to cook wood in closed oven retorts This method produces about 30 parts by weight of charcoal and also saves by-products such as tar, wood alcohol, acetic acid, and acetone.

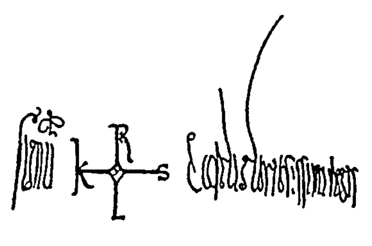
Pure charcoal burns without smoke and makes a hot fire. Formerly it was used as fuel in the reduction of metallic ores but has largely been replaced by coke. However, it is important in the production of silicon alloys and high chrome steel. Charring fence posts to give them a coating of charcoal protects them from decay. Charcoal is used in making gunpowder, in filtering water, curing tobacco, manufacturing glass, as an ingredient of poultry and stock feed, and as a motor fuel where gasoline is scarce

The adsorptive power of charcoal is greatly increased by a process called *activation.* This consists of treating charcoal with carbon dioxide, nitrogen, or other gases or with metallic salts. It is heated and kept at a high temperature for some time with little air present. Activated wood charcoal is used in gas masks to adsorb poison gases and filter them from the air.

CONQUEROR *and* EMPIRE BUILDER

CHARLEMAGNE (*shär'lē-mān*), or **CHARLES THE GREAT** (742?–814; ruled 768–814). "By the sword and the cross," Charlemagne became master of western Europe and saved for us many rights and privileges that we enjoy today. When Charlemagne became joint king of the Franks in 768, western Europe was falling into decay. Except in the monasteries, people had all but forgotten education, the arts, and representative government. Boldly, Charlemagne conquered barbarians and kings and restored the roots of learning and order.

CHARLEMAGNE'S SIGNATURE



Charlemagne "wrote" his signature by inserting the two small lines in the center of the monogram made for him by his clerk.

Born to Power

Charlemagne's grandfather was Charles Martel, the warrior who crushed the Saracens (*see* Charles Martel). Charlemagne was the elder son of Bertrade ("Bertha Greatfoot") and Pepin the Short, first "mayor of the palace" to become king of the Franks. Although schools had almost disappeared, historians believe that Bertrade gave the young Charlemagne some schooling and that he learned to read. Bertrade especially schooled him in piety. His devotion to the Roman Catholic church became the great driving force of his remarkable life

Striking Appearance and Unusual Personality

Charlemagne was tall, well over six feet, powerful, and tireless. His secretary, Eginhard, wrote that Charlemagne had fair hair and a "face laughing and merry . . . his appearance was always stately and dignified." He had a read wit, but could be stern.

His tastes were simple and moderate. He delighted in hunting, riding, and swimming. He wor the Frankish dress—linen shi and breeches, a silk-fringed tunic hose wrapped with bands, and, i winter, a tight coat of otter o marten skins. Over all these gar ments "he flung a blue cloak

and he always had a sword girt about him"

Charlemagne's character was contradictory In an age when the usual penalty for defeat was death, Charlemagne several times spared the lives of his defeated foes, yet in 782 at Verden, after a Saxon uprising he ordered 4 500 Saxons beheaded He compelled the clergy and nobles to mend their ways, but he divorced two of his four wives without cause He forced kings and princes to kneel at his feet yet his mother and two favorite wives often overruled him in his own household

Charlemagne Begins His Reign

At the age of 26 Charlemagne with his brother Carloman, inherited the kingdom of the Franks In 771 Carloman died, and Charlemagne became sole ruler At that time the northern half of Europe was still pagan and lawless In the south, the Roman Catholic church was striving to assert its power against the Lombard kingdom in Italy In Charlemagne's own realm the Franks were falling back into barbarian ways, neglecting education and Christianity

HOLY ROMAN EMPEROR

Durer here painted Charlemagne garbed like later rulers of the empire

Charlemagne determined to strengthen his realm and to bring order to Europe In 772 he launched a 30 years' campaign which conquered and Christianized the powerful pagan Saxons in the north He subdued the Avars, a huge Tatar tribe on the Danube He compelled the rebellious Bavarian dukes to submit to him

When he could, however he preferred peaceful settlement to war After the Lombard king Desiderius, seized papal lands Charlemagne offered to pay him to return them to the pope When the treacherous Desiderius refused Charlemagne seized his kingdom in 773–774 and restored the Papal States (*see* Papacy)

Military Genius

The key to Charlemagne's amazing conquests was his ability to organize During his reign he sent out more than 50 military expeditions He rode as commander at the head of at least half of them

He moved his armies over wide reaches of country with unbelievable speed, but every move was planned in advance Before a campaign he told the counts princes and bishops throughout his realm how many men to bring what arms they were to carry, and even what to load in the supply wagons. These feats of organization and the swift marches led Napoleon later to study his tactics

One of Charlemagne's minor campaigns has become the most famous In 778 he led his army into Spain to battle the infidel Saracens On its return, Basques ambushed the rear guard at Roncesvalles in northern Spain and killed 'Count Roland" Roland became the great hero of medieval songs and romances (*see* Roland)

Extent of Charlemagne's Realm

By 800 Charlemagne was the undisputed ruler of western Europe His vast realm covered what are now France Switzerland Belgium and Holland It included half of present-day Italy and Germany part of Austria and the Spanish March ('border") The broad March reached to the Ebro River

By thus establishing a central government over western Europe Charlemagne restored much of the unity of the old Roman Empire and paved the way for modern Europe

Pope Crowns Him Emperor

On Christmas Day in 800 while Charlemagne knelt in prayer in St Peter's in Rome Pope Leo III seized a golden crown from the altar and placed it on the bowed head of the king The throng in the church

THE GREAT MEDIEVAL EMPIRE OF CHARLEMAGNE

Charlemagne's skill as soldier and ruler held his sprawling empire together within natural lines of defense The Partition of Verdun in 843 (inset map) split it into three weak kingdoms The kingdom of Lothar (or Lothair) included modern Lorraine

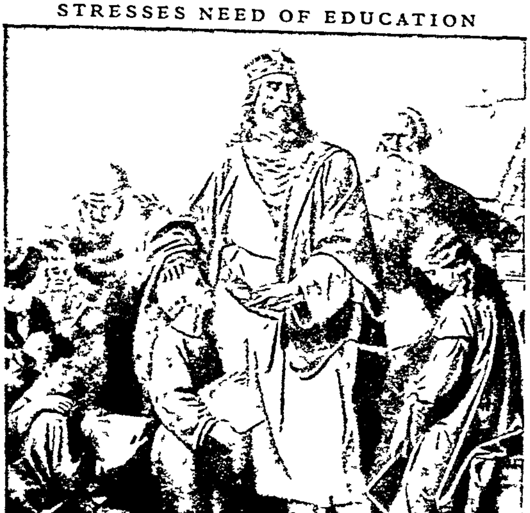
GIVES AUDIENCE TO VASSAL REPRESENTATIVES

The dress of the representatives (right) indicates that they are from Tatar and Slav tribes on the east fringe of the empire. The presence of the Christian clergy of the Franks (left) shows the close relationship between church and state.

shouted, "To Charles the August, crowned by God, great and pacific emperor, long life and victory!"

Charlemagne is said to have been surprised by the coronation, declaring that he would not have come into the church had he known the pope's plan. However, some historians say the pope would not have dared to act without Charlemagne's knowledge.

STRESSES NEED OF EDUCATION



Commending a studious peasant boy (left), Charlemagne chides a young noble (right) for not studying. Charlemagne warned the idler he should not count on his noble birth and wealth.

The coronation was the foundation of the Holy Roman Empire. Though Charlemagne did not use the title, he is considered the first Holy Roman emperor (*see* Holy Roman Empire).

Reforms and Strengthens Government

Charlemagne had deep sympathy for the peasants and believed that government should be for benefit of the governed. When he came to the throne various local governors, called "counts," had become lax and oppressive. To reform them, he expanded the work of investigators, called *missi dominici*. He prescribed their duties in documents called *capitularies* and sent them out in teams of two—a churchman and a noble. They rode to all parts of the realm, inspecting government, administering justice, and reawakening peasants, nobility, and clergy to their civil and religious duties.

Twice a year Charlemagne summoned the chief men of the empire to discuss its affairs. In all problems he was the final arbiter, even in church issues, and he largely unified church and state.

Revives Education and the Arts

Charlemagne was a tireless reformer. He sought to improve his people's lot in many ways. He set up money standards to encourage commerce, tried to build a Rhine-Danube canal, and urged better farming methods. He especially worked to spread education and Christianity throughout every class of people.

He revived the Palace School at Aachen, his capital. He set up other schools, opening them to peasant boys as well as nobles. It is said that he once found the poorer boys studying hard and the nobles lagging. He promised the earnest students rich rewards in later life, but sternly told the nobles: "You pretty and dainty little gentlemen . . . I care little for your noble birth . . . if you do not make haste to recover what you have lost by your neglect, you will never get favors from Charles."

Charlemagne never stopped studying. He brought an English monk, Alcuin, and other scholars to his court. He learned to read Latin and some Greek, but apparently did not master writing. At meals, instead of having jesters, he listened to men reading from learned works.

To revive church music, Charlemagne had monks sent from Rome to train his Frankish singers. To restore some appreciation of art, he brought valuable pieces from Italy. An impressive monument to his religious devotion is the cathedral at Aachen, which he built and where later he was buried.

At the death of Charlemagne in 814 only one of his three sons, Louis, was living. Louis' weak rule brought on the rise of civil wars and revolts. After his death his three quarreling sons split the empire between them by the Partition of Verdun in 843.

CHARLES, HOLY ROMAN EMPERORS

SEVEN rulers of the Holy Roman Empire were named Charles Charles the Great (Charlemagne) is considered the first though he did not use the title (*see* Charlemagne Holy Roman Empire) Of those who bore the title Charles V was the most important

CHARLES II the Bald (ruled 875–877) was the grandson of Charlemagne He became king of France in 840 (as Charles I) and ruler of the Holy Roman Empire in 875

CHARLES III the Fat (ruled 881–887) A great grandson of Charlemagne Charles the Fat became king of Swabia in 876 Holy Roman emperor in 881 and king of France in 884 (as Charles II) He was deposed as emperor in 887 and died the same year

CHARLES IV (born 1316 ruled 1347 1378) Charles IV was a member of the house of Luxemburg He became king of Bohemia in 1346 and became Holy Roman emperor in 1347 He issued a Golden Bull in 1356 which settled the empire s fundamental law (*see* Holy Roman Empire)

CHARLES V

Amberger s painting shows the emperor s jutting Hapsburg chin

CHARLES V (born 1500 ruled 1519–1556) At only 20 years of age Charles V ruled nearly half the world He became one of the most skilled of monarchs yet at 56 he voluntarily gave up his vast realm and retired to spend his last days near a monastery in the rugged Estremadura of western Spain

Charles was born Feb 24 1500 at Ghent in the Netherlands His mother was Joanna daughter of Ferdinand and Isabella of Spain his father was Philip of Hapsburg son of Maximilian archduke of Austria and Holy Roman emperor

Charles was a shy and somewhat frail boy but strong willed He became an excellent rider and hunter He preferred the outdoors to books but teachers and courtiers carefully schooled him for his future royal duties Charles spoke French and always considered the Netherlands his homeland He did not see Spain until he was 17 years old

The first of his many crowns came to him when he was only six when he inherited the kingdoms of Castile and the Netherlands Only ten years later at the death of his grandfather Ferdinand he became ruler of Spain as Charles I king also of Sicily and Naples and Spain s rich colonies in the New World The next year 1517 he sailed to Spain to establish his court at Valladolid At 19 he inherited Austria from his grandfather Maximilian the Holy Roman emperor

In 1519 Charles was elected Holy Roman emperor as Charles V and was crowned in 1520 He ruled a vaster territory than had any Christian monarch before him His realm spread over Europe except in France England and Russia and reached into the Americas

Though Charles had been trained in warfare since early boyhood he was always greedy for peace Whenever possible he settled disputes by compromise yet he was involved in wars throughout his life

He was a skilled leader in both land warfare and naval expeditions and was completely fearless Once when his aides rebuked him for exposing himself to danger he replied We were short of men and I could not set a bad example

His chief rival was Francis I of France who claimed Charles s possessions in Italy Three times between 1522 and 1544 Spanish armies had to defeat French forces before Francis gave up his claim

Meanwhile Charles was also warring against even more menacing foes—the Turks They had poured up

CHARLES V HEARS PIZARRO S REPORT

The Spanish explorer Francisco Pizarro (left) tells of the riches he found in Peru and points to trophies he has brought back Charles then supported Pizarro s expedition of conquest but historians believe he knew nothing of Pizarro s cruelty

the Danube Valley, taking his lands in Austria and Hungary. In 1532 he forced them from Austria but had to recognize their hold on Hungary. Still another threat were Mohammedan pirates, who raided his coast towns in Spain and Italy. Three times Charles fought them in their strongholds in northern Africa.

Charles, usually the victorious warrior, met complete defeat in his efforts to stop the great religious and social revolution in Germany, called the Reformation (*see* Reformation). There Martin Luther, a monk, led a revolt against the Roman Catholic church (*see* Luther). From 1521 to 1555 Charles tried to stem the rise of Protestantism; but in 1555 he had to sign the Peace of Augsburg.

In intervals of peace, he turned to statecraft to stabilize his realm. One of his favorite means was to arrange strategic royal marriages. He married Isabella of Portugal, betrothed his sister Mary to the king of Hungary, his brother Ferdinand to the king's sister, and his son Philip to Mary Tudor of England.

He let the diverse parts of his realm largely govern themselves but made improvements where he felt needed. He was especially interested in the rule of his colonies in the Americas.

Tired by his long, tumultuous reign, and especially by his failure to halt the Reformation, Charles resigned his realm to his son Philip II and his brother Ferdinand I (*see* Philip, Kings of Spain). Charles kept the title of Holy Roman emperor until his death but did not use its power. He retired to a small home adjoining St. Jerome's monastery at Yuste, where he died in 1558.

CHARLES VI (born 1685, ruled 1711–1740). Charles VI became Holy Roman emperor in 1711. He was the father of Maria Theresa and last of the direct male line of the Hapsburgs (*see* Maria Theresa).

CHARLES VII (born 1697, ruled 1742–1745). Charles VII, duke of Bavaria, ruled the empire for only three years. He had been elected by French opposition to the Hapsburgs.

CHARLES, *Kings of* ENGLAND, SCOTLAND, *and* IRELAND

TWO KINGS of Britain were named Charles. Both were of the house of Stuart.

CHARLES I (born 1600, ruled 1625–1649) ended his life on the scaffold. It was his unhappy lot to occupy the English throne in the days of the Puritan Revolution and at a time when new ideas of the rights of the people were coming into sharpest conflict with the old theory of the divine right of kings.

Charles was the son of James I (James VI of Scotland), first of the Stuart line. From his birth, he was a weak child. He did not learn to talk until his fifth year or to walk until his seventh. He stammered all his life. His character was a curious mixture of weakness and obstinacy. He followed the advice of his favorite ministers because he did not trust his own judgment, but once having formed an opinion he clung obstinately to it. Like his unpopular father, he lacked the skill of understanding the desires of his subjects and of winning their confidence.

In the same year that Charles succeeded to the throne (1625) he married a French princess, Henrietta Maria, the daughter of Henry IV. The marriage was unpopular in England because the queen was a zealous Roman Catholic and had been brought up in the court of an absolute monarch. Her influence with that of other advisers was largely responsible for confirming the king in the course of action that led to his war with Parliament.

The issue was primarily whether the king of England was an absolute king, like the sovereigns of continental Europe, or whether his power of levying taxes and of making laws was limited by the powers of Parliament. In addition to this, there was a quarrel about religion. Many of Charles's subjects, known as Puritans, wanted to simplify the Church of England's services by omitting many ceremonies used by Roman Catholics. Charles, on the other hand, wanted to retain as many as possible of the old ceremonies. He even went so far as to make people fear that he wished to restore Catholicism. So Charles was opposed both for religious and political reasons.

Charles Quarrels with Parliament

Charles dissolved two Parliaments because the House of Commons refused to vote money he demanded unless he recognized that his ministers were responsible to Parliament. On the advice of these ministers, Charles had embarked on foreign wars that were both expensive and disastrous. To pay for them, he resorted to forced loans and other irregular devices.

When Charles called his third Parliament, in 1628, he faced tremendous hostility. This Parliament stated its major grievances in the celebrated Petition of Right, which called the king's attention to his illegal exactions and restated the limitations of the king's authority. Charles signed the petition in order to get the money he needed. Then, angry at the humiliation he had suffered, he dissolved Parliament and determined never to call another.

For 11 years—from 1629 to 1640—no Parliament met in England. During this period Charles and his ministers thought of further unpopular devices to raise money. To equip a fleet, the king demanded "ship money" from his subjects, maintaining that this was not a tax. John Hampden, a Puritan, boldly refused to pay the 20 shillings levied upon him in order to bring the matter to court. Many people applauded his courageous stand (*see* Hampden).

The Long Parliament

In 1633 William Laud was made archbishop of Canterbury. Laud attempted to enforce his High Church policy in both Scotland and England. All Scotland rose in revolt when Laud attempted to impose a modified form of the English Prayer Book on the Scottish church. Unable to put down the revolt, Charles at length summoned another Parliament in 1640 but sent it home after five weeks. This is called the

Short Parliament When another Parliament was called in the same year it passed an act stating it could not be dissolved without its own consent This Parliament became famous as the Long Parliament

The Long Parliament began by imprisoning the king s chief minister the Earl of Strafford as well as Archbishop Laud in the Tower of London (Strafford was executed in 1641 and Laud four years later) In the Grand Remonstrance it listed Charles s faults and demanded that the king s ministers be responsible to Parliament The document was printed and circulated throughout the country Charles was furious and went to Parliament with an armed guard determined to arrest five of its members who led the opposition to him His victims however had been warned of his approach and had fled This illegal act swiftly brought on civil war

England s Civil War

Both Charles and Parliament at once began to gather troops Those who supported Charles were called *Cavaliers* Those who supported Parliament were known as Roundheads because some of them cropped their hair close The Roundheads controlled London Through Parliament they also controlled the navy and had the power of raising money by taxes

The Roundheads soon found an incomparable leader in Oliver Cromwell The battle of Marston Moor (1644) gave Cromwell s Ironsides the north of England where the king had enjoyed his chief support The battle of Naseby the next year completed the king s overthrow In 1647 he sought refuge with the Scottish army which had come to the aid of Parliament The Scots handed him over to Parliament

Many members of Parliament wanted the king restored to his throne To prevent this the army took a hand In 1648 Colonel Pride with a band of troops appeared at the door of the House of Commons and barred all Charles s supporters from entering This illegal act is known as Pride s Purge The sitting members of the Long Parliament popularly called the Rump —then set up a high court to try the king for treason The trial began Jan 20 1649 On January 27 Charles was found guilty and condemned as a tyrant, traitor murderer and public enemy Three days later he was beheaded in front of his palace of Whitehall in London while an enormous crowd looked on The Rump Parliament then proclaimed England a commonwealth (*see* Cromwell)

ILL-FATED CHARLES I OF ENGLAND

Charles I s insistence upon his divine rights brought on civil war and his own execution This famous picture is by Van Dyck

Charles met his fate with dignity and composure So striking was his bearing that one of his foes the Puritan poet Andrew Marvell wrote

> He nothing common did or mean
> Upon that memorable scene
> But bowed his stately head
> Down as upon a bed

Charles s faults were as a ruler As a husband and a father he was beyond reproach (*See also* English History)

CHARLES II (born 1630 ruled 1660–1685) was the second son of Charles I He was 19 years old and safe in France when his father was beheaded in 1649 England then became a commonwealth (that is a republic) with Oliver Cromwell as lord protector

The Royalists of Scotland at once proclaimed young Charles their king so he went to Scotland and in 1651 was crowned king of the Scots at Scone In the same year he marched into England with 10 000 Scots to halt Cromwell s advance but Cromwell defeated him at Worcester and put his army to rout For six weeks Charles wandered about a fugitive with a price of £1 000 set on his head More than 40 persons shared his secret yet not one betrayed him After an amazing series of

CHARLES II, THE "MERRY MONARCH"

This portrait of Charles II by an unknown artist shows the king in the type of wig worn by the Cavaliers.

adventures, including his concealment in a tree, the "royal oak," he escaped to France and spent ten years more in exile

The Restoration

Cromwell died in 1658, and his son Richard proved unable to carry on the government. A new Parliament was called in 1660. It acknowledged Charles II as king, thus restoring the Stuart line. There was great rejoicing when Charles returned to England.

Charles II was not an admirable person, but he was an interesting one. Decidedly selfish, he had an easy good nature and charm of manner. One of his courtiers said that "he never said a foolish thing or did a wise one." Charles's reply was that his acts were those of his ministers, but his words were his own. He was well read, a patron of the drama, of painting and architecture. He was interested in science and founded the Royal Society in 1662, with himself as first president. However, the immorality of the "merry monarch" and the license that prevailed at his court became a scandal to many more than the members of the old Puritan party.

Charles's one purpose throughout his reign was to make himself an absolute monarch like his contemporary, Louis XIV of France. This led him to try to raise a standing army, to restore Catholicism, and to secure a close alliance with Louis XIV, to whom he looked for money and troops. He followed a crooked course, bribing, flattering, and yielding to Parliament whenever opposition proved too strong; for he was fully resolved "never to set forth on his wanderings again."

During the last five years of his reign Charles attained a great degree of success in all his policies The money he received from Louis XIV made it possible for him to rule after 1680 without calling Parliament, and thus prevented it from excluding his Catholic brother James from succession to the throne. He himself on his death bed became a member of the Roman Catholic church.

Charles married Catherine of Braganza, daughter of the king of Portugal, but left no legitimate children. One of his favorites was Nell Gwynn, an actress.

During his reign the Great Plague of London occurred (1665) and in the next year, the Great Fire. There also took place two wars with the Dutch, but Parliament finally compelled Charles to make peace with this Protestant power. (*See also* English History.)

CHARLES, *Kings of* FRANCE

THE FIRST Charles to rule over the French was Charlemagne. His reign, however, belongs rather to the history of western Europe than to any one of the separate kingdoms, and he is therefore not included in the numbering of the French kings who bore the name Charles (*see* Charlemagne). So Charlemagne's grandson, Charles the Bald, is called Charles I of France, though he is Charles II of the Holy Roman Empire. Similarly Charles the Fat is Charles II of France and Charles III of the Holy Roman Empire (*see* Charles, Holy Roman Emperors).

The next French kings who bore the name Charles were Charles III, called the Simple (ruled 893–929), and Charles IV, called the Fair (ruled 1322–1328).

CHARLES V (born 1337, ruled 1364–1380) was called Charles the Wise. His reign saw the beginning of the second period of the Hundred Years' War with the English. He was not himself a good warrior because of his poor health; but with the aid of his general Bertrand du Guesclin, he succeeded in driving the English almost completely out of France. (*See* Hundred Years' War.)

CHARLES VI (born 1368, ruled 1380–1422), the son of Charles V, became insane when he reached manhood. Struggles for the control of the government divided the country into two great factions. The Duke of Burgundy, uncle of the king, had the king's brother, the Duke of Orleans, assassinated. Then furious civil war burst forth between the houses of Orleans and Burgundy. The Count of Armagnac led the Orleans faction.

In the midst of this civil strife the Hundred Years' War with England was renewed. England's hero king, Henry V, was victorious in 1415 at Agincourt (*see* Agincourt). In 1419 the Burgundians formed an alliance with the English. The young English king married Charles's daughter and forced on the French the Treaty of Troyes (1420) by which the king of

England should succeed Charles VI when he should die Both King Charles and King Henry d ed in 1422 Henry VI of England ten months old was acknowledged king of France In the south however the French claimant Dauphin Charles (later Charles VII) retained a feeble hold (*See* Hundred Years War)

CHARLES VII (born 1403 ruled 1422 1461) was not able to be crowned king until seven years after the death of his father Charles VI—and then he owed his crown to the courage faith and enthusiasm of a simple peasant maid Joan of Arc In the period before he came to the throne he was called the Dau

JOAN OF ARC AT THE CORONATION OF CHARLES VII

Here we see Charles receiving the crown in Reims Cathedral while Joan of Arc gives thanks Charles owed his throne to th s inspired peasant girl from Domrémy who led the French armies to victory against the Engl sh Charles was of weak character When the English later condemned Joan of Arc to be burned at the stake her king did nothing to help her

phin. (This name, given to the eldest son of the French king, corresponded to the English Prince of Wales.)

After a series of brilliant successes in the field over the English, Joan was able to take the Dauphin to Reims for coronation in the cathedral where his ancestors had been crowned. When Joan fell into the hands of the English, Charles made no effort to save her, and she was burned at the stake as a heretic. Her influence, however, lived after her. Before the end of Charles's reign the English were driven from all France, except Calais, and the Hundred Years' War was at an end. (*See also* Joan of Arc; Hundred Years' War.)

Charles VII was timid and irresolute and haunted by fears that plotters would kill him; yet he proved to be remarkably strong in administration. His strength came largely from his capable counselors, who made many decisions for him and carried them out in his name. By a series of reforms he gave to the crown a standing army with improved artillery—for cannon were then in use—and a permanent source of income. He also encouraged commerce and literature. At the end of his reign the king of France was in a stronger position than he had been at the end of the reign of Charles V.

CHARLES VIII (born 1470, ruled 1483–1498) was a feeble successor to his father, Louis XI, that cold, cunning Renaissance ruler who had done so much to repair the ravages of the Hundred Years' War. Charles was only 13 years old when he came to the throne. For a time he submitted to the regency of his elder sister, Anne of Beaujeu, of whom her cynical father had once said: "There is no such thing as a wise woman, but Anne is the least foolish woman in the world." Anne proved to be an able regent and soon showed the feudal princes that they must respect the power of the throne. She brought Brittany into the French kingdom by arranging the marriage of the young Charles VIII to Anne de Bretagne, duchess of Brittany.

When Charles reached the age of 21, he took over the rule of France. In contrast to his shrewd sister, he was an impractical dreamer. He planned first the conquest of Italy and then a mighty expedition against the Turks at Constantinople. At first success attended his expedition into Italy in 1494. The people of Florence drove out their rulers, the Medici, and welcomed Charles to their city. He entered Rome and even Naples speedily fell into his hands.

Charles's enemies quickly formed a league against him, and he was glad to escape in 1495 from the country he had hoped to conquer. He returned home enthusiastic about the art and learning of Italy and thus helped to hasten the spread of the Italian Renaissance in France.

CHARLES IX (born 1540, ruled 1560–1574) came to the throne in the midst of the Reformation and the fierce civil wars between the Roman Catholics and the Huguenots (Protestants). The crimes that mar the history of his reign were largely the work of his ambitious mother, Catherine, of the famous Medici family (*see* Medici).

Charles was only ten years old when he became king, and Catherine claimed the right to rule for him. Even when he reached manhood he was weak and hesitating and she continued to dominate him. In her desire to bring about the death of Gaspard de Coligny, the Huguenot leader, she goaded her son into giving orders that led to the Massacre of St. Bartholomew in 1572, when thousands of Huguenots, including Coligny, were killed (*see* Coligny). This crime preyed on Charles's mind and he became melancholy. He died two years later of a fever.

CHARLES X (1757–1838; ruled 1824–1830) belongs to a much later day, for he succeeded his brother Louis XVIII in 1824. He was a man of old-fashioned ideas who, even after the French Revolution, believed in the divine right of kings. His ambition was to restore the clergy to its former high position in the state, to create a powerful aristocracy, and to surround it with privileges.

In 1830 Charles dissolved the Chamber of Deputies and boldly issued a series of decrees ending the freedom of the press and completely restoring the power of the king. Two days later the republicans organized a successful revolution in Paris, which lasted only "three glorious days" (July 27–29). Charles then abdicated and fled to England, and Louis Philippe was placed on the throne.

CHARLES X OF FRANCE

Charles X, the last French king of that name, lost his throne through a foolish attempt to re-establish the old autocracy. Here we see him dressed in all his regal finery.

CHARLES XII King of Sweden (1682–1718) Brilliantly planned and executed battles proved Charles XII of Sweden a military genius but his stubborn insistence on war all but brought ruin to his country He won his first victory before he was 19 years old and by the time he was 26 he had won all his great victories In the end however he not only lost control of the Baltic Sea but most of Sweden s provinces on the Baltic s eastern and southern shores as well

Charles the son of Charles XI was born in Stockholm June 17, 1682 As a young boy he studied and admired great military leaders particularly Alexander the Great He liked to hunt and to play rough games He ate simple coarse food and followed a Spartan life in order to build up his own strength and endurance He was intelligent but self willed and when he became king at the age of 15 he refused to be crowned by any but his own hand

Frederick IV of Denmark Peter the Great of Russia and Augustus II of Poland and Saxony began the Great Northern War in 1700 to wrest Sweden s Baltic provinces from the youthful king Charles struck back at his enemies one by one He crossed the narrow sea to Zealand and besieged Copenhagen forcing Frederick to accept the Peace of Traventhal (August 1700) Immediately he sailed across the Baltic with 15 000 men and on Nov 30 1700 he routed 100 000 Russians that were besieging the city of Narva He then drove south into Poland

During the next six years Charles fought and won many battles against Russia and Poland He replaced Augustus on the Polish throne with a king of his own choice He frightened Emperor Joseph I of the Holy Roman Empire into granting freedom of worship to the Lutherans of Silesia His devotion to warfare led many people to call him the madman of the North

Charles Invades Russia

Peter's soldiers continued to harass the Swedes and in 1707 Charles led his army deep into Russia Disaster began when Peter defeated a Swedish army that was bringing supplies and reinforcements Charles s Cossack allies failed him When Charles tried to capture Russian supplies at Poltava about 800 miles southeast of the Baltic the Russians overwhelmed his poorly equipped soldiers (July 8 1709)

Charles was wounded and fled with a remnant of his army into Turkey From 1709 to 1714 he unsuccessfully urged the Turkish sultan to war on Russia In 1713 the sultan ordered Charles to leave For more than a year the Swedish king refused Charles reached Stralsund on the Baltic by an overland journey in 1714 For a time he withstood a siege there He then escaped across the Baltic to Sweden

By this time Sweden had lost most of its outlying provinces To regain some of its lost territory Charles raised a new army and invaded Norway (then part of Denmark) On Dec 11 1718 as he laid siege to Fredriksten he was killed

Among other Swedish kings named Charles were CHARLES IX reigned 1604–11 the father of Gustavus Adolphus CHARLES X 1654–60 nephew of Gustavus CHARLES XI 1660–97 and CHARLES XV 1859–72

CHARLES THE BOLD Duke of Burgundy (1433–1477) Charles Duke of Burgundy whose exciting story is told in Sir Walter Scott s Quentin Durward lived at the end of the Middle Ages He was a little man with blue eyes brown beard and a shock of black hair He was strong industrious and pious and also proud and ambitious

Charles inherited from his father in 1476 the French duchy of Burgundy His lands included also Franche-Comté Luxemburg Flanders Artois Brabant and the Netherlands (Belgium and Holland) His lands were divided however and he was ambitious to add Alsace and other territories to unite the northern and southern sections Then he would have a strong state between France and the German lands over which he hoped to rule as king

The king of France Louis XI was trying to free France of feudalism and bring all the great feudal states into one kingdom Charles—whose power was equal to the king s—ravaged the king s lands and encouraged other nobles to resist him Rashly the king paid a visit to Charles hoping to gain by his wits what he could not win by force of arms

While the king was with him alarming reports reached Charles that the citizens of Liége had revolted against him He well knew that they had been stirred up by the shrewd and treacherous Louis Louis was in his power but he had promised him that he should be safe while he was in Burgundian territory He kept his word However he forced the king to go with him on his expedition against Liége and to sit by while its walls were destroyed and its citizens suffered death or exile for trusting to Louis promise of aid

Charles then turned his attention eastward He easily mastered the duchy of Lorraine but his conquests in Alsace brought him into conflict with the sturdy mountaineers of Switzerland Charles basely slaughtered the inhabitants of the little town of Granson after its surrender on terms In return the Swiss inflicted a severe defeat on Charles near that city (March 1 1476) A few months later (June 21 1476) the Swiss cut to pieces at Morat a second army raised by the haughty duke

In January Charles received news of the revolt of the town of Nancy which he had conquered the year before He hastened into Lorraine to put down the revolt Once more his horsemen were no match for the intrepid Swiss pikemen who had come to Nancy s aid The battle (Jan 5 1477) was short

When it was over, Charles the Bold could not be found. Three days later, a body on the battlefield was identified as that of the duke.

Louis XI deprived Charles's daughter, Mary of Burgundy, of all her French possessions. The Netherlands passed to the House of Hapsburg when Mary married Maximilian of Austria.

The name Burgundy has not always meant the same territory. There were at different times in the Middle Ages five different kingdoms of Burgundy. Most of these included the valley of the Rhone River, which was never a part of Charles's possessions.

CHARLES MARTEL' (688–741). By the year 732, exactly 100 years after the death of Mohammed, the flood tide of the Saracen armies had swept west from Arabia across northern Africa, had conquered Spain, and was rolling irresistibly northward through France.

The sword of Islam was striving to convert the world to Mohammedanism by the effective method of exterminating unbelievers. Sixteen years before, the Saracen hordes, sweeping northward at the eastern end of the Mediterranean, had been stayed at Constantinople, and Christendom had withstood unshaken the first great hammer blow of the Moslem power. Now the fate of Europe again hung in the balance, as the green banner of the Prophet stood before Tours, within striking distance of Paris.

The defeated leaders of southern Gaul were sending up a despairing cry for help. Suddenly out of the North a Frankish host headed by Charles, mayor of the palace for the Merovingian puppet king at Cologne, fell upon the invaders between Poitiers and Tours. A terrible battle followed. The wild riders of the desert dashed hour after hour in ceaseless charges against the solidly compacted infantry of the North. They came on like the leaping waves of the ocean, to be scattered backward like its spray. The folds of the eastern turban afforded slight protection against the huge swords wielded by the stalwart arms of the Frankish veterans, while the scimitars of Damascus glanced harmlessly from the stout helmets of steel and thick leather corselets of the Franks. Finally the Moslem chief was killed and the foe was sent flying back to the Pyrenees. Europe was again saved to Christianity and Charles had earned his title "Martel," meaning the Hammer.

Charles Martel, as conqueror and virtual ruler of the entire Frankish kingdom—though he never assumed the crown—prepared the way for his son, Pepin the Short, to gain the throne. Together they laid the foundation for the future world power of Pepin's son, Charles the Great (Charlemagne).

CHARLESTON, S. C. The beautiful city of Charleston occupies a mile-wide peninsula in a bay between the Ashley and Cooper rivers, a few miles from the Atlantic Ocean. Running north from the Battery (or lower water fronts) are King and Meeting streets, the main thoroughfares. Broad Street divides the old, fashionable, residential city to the south from the business and industrial city to the north. Waterfront driveways meet in White Point Gardens at the tip of the peninsula.

AN OLD CHARLESTON MANSION

This house was built before the start of the Revolutionary War by Col. John Stuart. The painted brick wall, probably built at a later date, encloses a well-shaded lawn and garden.

In its old homes and streets lingers the flavor of the days when Charleston was the gay social, political, and economic center for the royal province of Carolina. Charleston was important in colonial times and in the Revolutionary and Civil wars. Nearby is Fort Moultrie, a battle site in the Revolution. In the harbor stands Fort Sumter, target for the first shot of the Civil War. In White Point Gardens, Stede Bonnet and his buccaneer crew were hanged in 1718. When Boston had its Tea Party, Charleston locked its tea in the Old Exchange rather than pay tax. Sir Henry Clinton used the Miles Brewton house on King Street as his headquarters during the British occupation in 1780–82. Built about 1765, it is one of the most nearly perfect Georgian houses in America. (For history, *see* South Carolina.)

Among the old buildings now used as museums is the Old Powder Magazine, built in 1703. Most notable is Charleston Museum, which dates from 1773. The Charleston Library Society, organized in 1748, has newspapers dating back to 1732. The county's free library is in a Classic revival mansion. The Dock Street Theater, opened in 1736, has been restored. The theater and the Gibbes Art Gallery are managed by the Carolina Art Association. In City Hall hang John Trumbull's 'Portrait of George Washington' and Samuel F. B. Morse's 'Portrait of James Monroe'.

The College of Charleston, founded in 1770, is the oldest municipal college in the country. Other educational institutions are the Medical College of the State of South Carolina and the Citadel (Military College of South Carolina).

Each spring the Azalea Festival brings thousands of visitors to Charleston and nearby gardens. Along the Ashley, the magnificent Magnolia Gardens were laid out by a clergyman planter a century ago. The formal Middleton Gardens were built about 1750 by Henry Middleton, a president of the Continental Con-

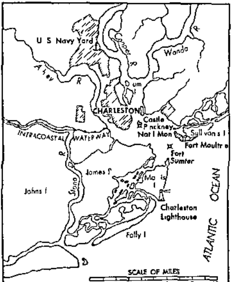
gress The shadowy Cypress Gardens have been formed about the reserve waters of an old rice plantation

A three-mile bridge over the Cooper River connects Charleston with the mainland on the east On the neck of the peninsula are railroads, industrial plants, docks, and warehouses Important industries are shipbuilding and repairing, petroleum refining, and the manufacture of fertilizers, pulp, paper, textiles cigars, and steel and wood products The port carries on a large trade in these products and in cotton, lumber sea food, and fruit It is the official state port and is on the Intracoastal Waterway The harbor can berth the largest ships and hundreds of vessels The United States Navy maintains a regional headquarters and shipyard on the Cooper River

Charleston has the mayor-council form of city government Population (1950 census), 70,174

CHARLESTON, W VA The capital city of West Virginia serves as hub of the Kanawha Valley The valley is cut into the Appalachian plateau in the western part of the state It is a thriving industrial area and one of the richest soft-coal and natural-gas regions in the world Charleston stretches along the north bank of the Kanawha River. The Elk River, flowing into the Kanawha at this point, divides the city into east and west sections

CITY OF THE 'OLD AND THE NEW



Charleston, S C , is rich in historic landmarks, many dating back to colonial times The city s great natural harbor has made it one of the leading ports on the Atlantic

The main industry of the Charleston area is the production of chemicals Large quantities of synthetic chemical products, such as nylon and resin plastics, are produced here and shipped elsewhere to be made into finished goods Other plants manufacture glass, steel, axes, antifreezes, ammonia, and chlorine Served by four railroads, Charleston is an important distributing point for manufactured goods and for the extensive valley resources of coal, oil, and natural gas

Charleston's history dates from the establishment of Fort Lee in 1788 by Col George Clendenin Its early settlers were Scotch-Irish and Germans from the Shenandoah Valley Daniel Boone lived here with his family from 1789 to 1795 He represented Kanawha County in the Virginia Assembly for one term Another pioneer of this period was "Mad Ann" Bailey, famed for her Indian dress and rifle marksmanship

Charleston became the permanent state capital in 1885 The capitol, overlooking the Kanawha River, is of Italian Renaissance architecture and was completed in 1932 Among the city's attractions are a five-lane river-front boulevard, a large civic auditorium and Kanawha Airport Morris Harvey College and Mason College of Music and Fine Arts are located here The city has the mayor-council form of government (*See also* West Virginia) Population (1950 census) 73 501

CHARLOTTE, N C Its location in the center of the fertile Piedmont Plain has made Charlotte the largest city of the two Carolinas The city is the trade center for a wide area and one of the nation's largest textile centers Cotton for its plants comes from surrounding farms and power for its looms from hydroelectric developments in the Appalachians, to the west Cotton gins, cotton mills and hosiery factories cluster around the city's outskirts Workers cottages, all much alike stretch in long rows about these factories Other manufactures include machinery, chemicals, and furniture

Wilderness trails crossed at the point that is now Independence Square The first cabins were built here in 1748 The settlement was named for Queen Charlotte, the wife of George III America's first declaration of independence (the Mecklenburg Declaration) was signed here on May 20, 1775, by Scotch-Irish and German settlers from Virginia and Pennsylvania During a British occupation for two weeks in 1780 local patriots so harassed the enemy that Lord Cornwallis called the town "a damned hornets' nest"

At the end of the 1700's Charlotte was the scene of the nation s first gold rush The government began operating a mint here in 1836 The mines were closed after gold was discovered in California in 1848, but they were reopened briefly in the 1930's Charlotte had woolen mills as early as 1854 The city's first rail line, to the sea, began operation in 1856 During the Civil War Charlotte became an inland naval supply base for the Confederates In the last days of the war, Jefferson Davis, president of the Confederacy, held the last full meeting of the Confederate cabinet in Charlotte in April 1865 The city's real growth as a textile center began in the early 1900's

Charlotte is the seat of Queens College, for women, and the Johnson C Smith University, for Negroes The Mint Museum, reconstructed on the plan and of the materials of the old mint, houses an art collection Charlotte was incorporated in 1768 It has the council-manager form of government (*See also* North Carolina) Population (1950 census), 134 042

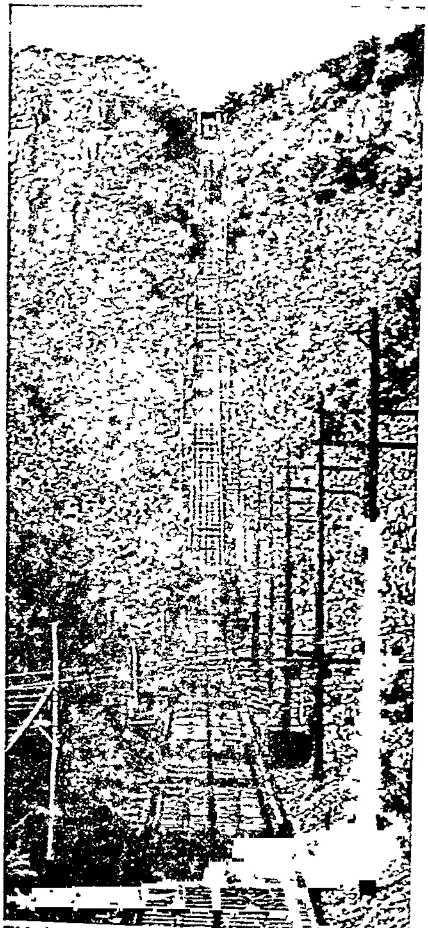
CHÂTEAU-THIERRY (*shā-tō' tyĕ-rē'*), **FRANCE.** The name of Château-Thierry recalls the most critical period of the first World War. Near this ancient French town, the power of Germany spent itself in a last vain drive to capture Paris during June and July, 1918. And from here the Allies began the eastward march that ended across the Rhine.

Château-Thierry lies on the River Marne, 47 miles east and slightly north of Paris. With Reims, 32 miles farther east, and Soissons, 23 miles to the north, Château-Thierry forms a great triangle commanding the railway and river approaches to Paris.

On May 27, 1918, the German army smashed into this triangle, capturing Soissons May 29 and occupying Château-Thierry two days later. To halt the advance, American troops rushed to the aid of the weary French forces. The 7th machine-gun battalion of the Third Division arrived in time to hold the Château-Thierry bridge over the Marne. When other American units reinforced the line, word was cabled to all parts of the world that the Americans had saved Paris. Later these troops took part in the counterattack which swept the Germans out of the triangle.

Château-Thierry today is a city of 7,283 people (1946 census). Its inhabitants inherit from their ancestors a faculty for repairing the ravages of war, for their little town has been sacked and destroyed about every hundred years since the 15th century. The poet La Fontaine was born here in 1621. On the top of a near-by hill are the ruins of a castle, supposedly built by Charles Martel for the Frankish king Thierry IV, for whom the town is named.

A STEEP CLIMB UP LOOKOUT



This inclined cable railway, which scales Lookout Mountain, has a grade of 73 degrees at the point shown in the picture.

CHATHAM (*chăt'ăm*), **WILLIAM PITT, EARL OF** (1708-1778). "I know that I can save the country and that no one else can," proudly boasted William Pitt the Elder, in 1757, when England was losing battle after battle in the great Seven Years' War.

There was little in Pitt's background to warrant such a statement. He did not belong to the great noble families which had long governed England. He had studied at Eton but he had left Oxford before obtaining his degree because of his life-long enemy—gout. He had served for a time in the army. In 1735 he had entered the House of Commons from the "pocket borough" of Old Sarum, which his family owned.

In parliament Pitt won notice for his vigorous opposition to the governing clique then in power. But he received no official recognition until 1746 when he was finally named to a minor office. Even this appointment contradicted the wishes of George II whom Pitt had angered by his attacks on Hanover.

But it was the support of the people, not of the king, that finally gave Pitt the coveted office of prime minister. He had gained the public confidence during a term as paymaster by refusing to accept anything except his salary. As a result, when England suffered defeats at the beginning of the war the people demanded the "Great Commoner" so loudly that the king at last yielded.

As prime minister Pitt's fiery leadership stirred the entire government to greater activity. He appointed navy and army officers solely for their ability. He sent Gen. James Wolfe to Canada and won that land for Great Britain. He encouraged Clive in India and gave aid to England's ally on the continent, Frederick the Great of Prussia.

But before the end of the war George III, who became king in 1760, undermined Pitt's influence over the cabinet. As a result Pitt resigned a year later. Returning to his seat in the House of Commons he upheld the American colonists in their opposition to the Stamp Act and rejoiced in their resistance.

In 1766 Pitt again became prime minister, but his health failed and for critical months he left everything to subordinates. Also, he lost popular support by accepting the title of Earl of Chatham, which transferred him to the House of Lords. In 1778 he made his last speech, opposing American independence. He collapsed at the end of the speech and died a few weeks later.

Chatham's younger son, also named William Pitt, won even greater fame for his statesmanship in the trying days of the French Revolution and the Napoleonic Wars. (*See* Pitt, William, the Younger.)

CHATTANOOGA, TENN. A favorable location astride natural transportation routes gave Chattanooga its start. Other natural advantages—near-by deposits of coal, iron, and clay and vast water-power resources—led to its growth as a manufacturing center.

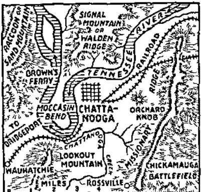
Chattanooga lies on the Tennessee River in a gap in the Appalachians which provides a passage from the

Atlantic coastal states to the northeastern Tennessee and Ohio valleys Thus, when the state of Georgia in 1836 decided to build the Western and Atlantic Railroad northwest from the site of Atlanta to tap the Tennessee Valley, the route reached the spot where Chattanooga now stands Soon a network of railroads radiated from the site A town grew up and was incorporated as Chattanooga in 1839 In 1860, the census showed it to have 2,545 inhabitants

Because of its strategic situation, Chattanooga and the surrounding region were the scene of heavy fighting during the Civil War (*see* Chattanooga, Battle of) For many years after the war, growth was slow Then in 1913, a dam, power house, and navigation lock were completed at Hale's Bar on the Tennessee 33 miles below the city. Cheap hydroelectric power gave impetus to manufacturing, and today the city's products include steam boilers, farming and oil-well machinery, clay and metal pipe, stoves, bathroom fixtures mill supplies, furniture, bottles, structural steel, and cotton, wool and silk textiles. One of the huge dams of the Tennessee Valley Authority development project is just north of the city.

The heart of Chattanooga is on level ground 698 feet above sea level. Two highway bridges across the Tennessee and four tunnels bring national highways into the mountain-ringed city The surrounding ridges and mountains are dominated by Lookout Mountain, some three miles southwest, which rises 2,126 feet above sea level All the heights are heavily wooded, with parks at historic spots, and are favorite resorts for hikers and tourists Except for a national military cemetery, the battlefield of Missionary Ridge is now a fine residential district, but the battlefield of Chickamauga, across the Georgia border, is a national military park Among the city's educational institutions are the University of Chattanooga, established 1866, and a conservatory of music It also supports a symphony orchestra and a Little Theater

A SCENE OF TERRIFIC BATTLES



This map shows Chattanooga and its surroundings as they were during the Civil War East of Missionary Ridge is the gap leading to Atlanta

A Cherokee Indian trading post called Ross' Landing originally stood on the site of Chattanooga The city's name came from Tsatinugi a Choctaw name given to the post office, which was established in 1838 The commonly accepted translation of the word is "crow's nest" Chattanooga has had the commission form of government since 1911 Population (1950 census), 131,041.

Chattanooga, Battle of One of the most dramatic reversals of fortune in the Civil War was the Union victory at the Battle of Chattanooga It followed the rout of the Union army under General Rosecrans by the Confederates under General Bragg at Chickamauga, on Sept 20, 1863 (*see* Thomas, Gen George Henry) Rosecrans' army took refuge in Chattanooga, Tenn, while Bragg occupied Missionary Ridge east of the city and Lookout Mountain to the southwest

Roads made impassable by rain and Confederate troops cut the Union army off from its base of supplies at Bridgeport, Ala, downstream on the Tennessee River Prospects for a retreat were not bright, because the horses were fast becoming too weak from lack of food to pull cannon and supply wagons

When the peril became acute, the Federal government sent Sherman with an army from Vicksburg, sent Hooker and 15,000 men from the east, and placed Grant in supreme command Grant replaced Rosecrans with Thomas and promptly launched the operations which together make up the Battle of Chattanooga On Oct 27 and 28, with minor engagements at Brown's Ferry and Wauhatchie, he cleared the Tennessee River of Confederates west of Lookout Mountain and seized a direct road to Bridgeport

The Noted "Battle Above the Clouds"

After capturing Orchard Knob, a hill lying west of Missionary Ridge, on Nov 23, Grant sent Hooker on Nov 24 to attack Lookout Mountain—a seemingly foolhardy move, because the mountain-sides were steep and choked with vegetation Moreover, a thick fog had gathered—which gave the battle its name But Hooker had more than 9,000 men against fewer than 2,000 defenders, and by afternoon the lower slopes were won Meanwhile, Sherman, according to Grant's plan, attacked the north end of Missionary Ridge and Bragg abandoned Lookout Mountain to meet him An unsuspected gulley and a stubborn defense stopped Sherman, and a wrecked bridge kept Hooker from attacking. By the afternoon of Nov 25, Grant was facing defeat unless he could weaken the Confederates' defense against Sherman

He ordered Thomas to capture a line of rifle pits at the foot of the Ridge But, this done, Thomas' men, instead of halting as ordered, followed on the heels of the Confederates to the top of the ridge The astonished Union generals could only follow, and the equally astonished Confederates at the top broke and fled Soon Bragg's entire army was in headlong flight

This victory, snatched from defeat by the Union men, gave the North control of the railroads centered in Chattanooga, and left the South only one route, through Atlanta, between the east and the west During these battles the Union army, with some 56,000 men, suffered 5,815 casualties The Confederates, with about 41 000, lost 6,687 killed, wounded, or captured

CHAUCER, *the First Great* ENGLISH POET

CHAUCER (*cha'sẽr*), GEOFFREY (about 1340–1400). Father of the English language, Morning Star of Song, Geoffrey Chaucer yet ranks, after five centuries, among the three or four greatest English poets. He was the first to commit to lines of universal and enduring appeal a vivid interest in nature, books, and people. Many-sided as Shakespeare, he did for English narrative what Shakespeare accomplished for drama. If he lacks the profundity of Shakespeare, he excels in playfulness of mood and simplicity of expression. Though his language often seems quaint to us, he was essentially modern. Familiarity with the language and with the literature of his contemporaries convinces the most skeptical that he is on this side of the line between the old and the new, nearer to the present than many writers born long after he died.

GEOFFREY CHAUCER

No contemporary portrait of Chaucer is known to exist. The painting above, in the National Portrait Gallery, London, is supposed to have been copied after a miniature, in a 15th-century manuscript, made from memory by a fellow-poet and disciple.

The Poet's Life

Geoffrey Chaucer was born in London, probably between 1340 and 1344. He was the son of Agnes de Copton and John Chaucer, a prosperous wine merchant. The name, from *chaussier*, indicates ancestors who were shoemakers. In 1357, when he was between 13 and 17 years old, Geoffrey was a page in the household of King Edward's son Prince Lionel and his wife Elizabeth. We know this from an entry in Countess Elizabeth's household account book, which records the purchase of a suit of clothes for Geoffrey Chaucer, including a pair of red and black hose and a pair of shoes. These must have been lively days for the young page, for old records show us the Countess and her household constantly on the move from one palace or great mansion to another. We even find mention of a trip to see the lions in the Tower of London. Two years later, Chaucer was with an army that Edward III led into France during the Hundred Years' War. He was taken prisoner by the French, but was soon (1360) ransomed by the King for a sum equivalent to about $2,400 in our money.

Of his next seven years, we know nothing certain; but there is reason to believe that he may have been studying law in London. By 1367 he was a member of the royal household with the rank of yeoman, and later, of squire, with a regular pension or salary. He also had a wife, Philippa, who was a member of the queen's household. Thus some time in his twenties Chaucer was launched on the official career which he followed the rest of his days. For the next 30-odd years he served two kings (Edward III and Richard II) in important offices and diplomatic missions abroad. Between 1370 and 1378 he was sent on seven missions to France, Flanders, and Italy. From 1374 to 1386 he was controller of the customs in London. In 1385 he was appointed justice of the peace, and in 1386 he sat for one term in parliament. From 1389 to 1391 came a succession of onerous and responsible posts: he was made clerk of the king's works with charge of Westminster Palace, the Tower of London and other palaces and manors, he was put on a commission to survey the roads, bridges, and ditches along the Thames near London; and he was put in charge of repairs to St. George's Chapel at Windsor. A less exacting post fell to him in 1391, when he was made subforester of one of the king's parks. This position he may have held until his death, Oct. 25, 1400.

Soldier, diplomat, justice of the peace, member of parliament, and man of affairs, Chaucer lived a full and busy life. He was born soon after the beginning of the Hundred Years' War; he lived through the terrible years of the Black Death through John Wyclif's dramatic challenge to the established church, through the Peasants' Revolt of 1381, and through the deposition of Richard II.

Poet of Nature

London, with its 40,000 people, was then a rural city. Garden and orchard surrounded the homes; field and meadow were in sight of Chaucer's window; moor,

heath, and forest were within easy walking distance A boy, he skated across the frozen ponds but shared with most others a dislike of the cold, and, though responsive to the beauty of stars on a frosty night he *preferred showers of April*, garlands of May and melody of birds He is the poet of dawn and spring

He throve on literature both classic and recent Ovid, Vergil, Livy, Boethius Petrarch Dante and Jean de Meun are among the authors of whom his pages are abundantly reminiscent, some of them he transmuted into living English Literature of the past he got not infrequently by word of mouth, since printing was yet to be invented and books were scarce Taking what he needed from others he remolded and immortalized it with narrative skill yet unsurpassed His foremost characteristic is humor, twinkling, quietly glowing, or loudly robust

Poet of Humanity

In his England of expanding trade with all nations, England under that Edward who has been called the Father of English Commerce, he met shipman, merchant, overseer, plowman In an era of changing religious ideas, he met the members of the various clerical orders from parish priest to abbot, and he probably knew John Wyclif, who wanted to reform the church Yet, though his sharp eye detected abuses in the church, he was not deeply concerned nor was he particularly sympathetic with reformers In his old age he made "retractations," begging God's forgiveness for "lewd songs" written, thanking God for lives of saints he had told By that time, however, he felt old, his thoughts no longer fixed on earth In his prime he wrote sanely, heartily, about men as he saw them leaving the reader to draw conclusions He knew men of law and, in that period of his life about which nothing has been revealed, he may have studied law He knew doctors and may have studied medicine in those same hidden years He knew inn keepers at whose inns he doubtless drank the wine they had bought from his own father On trips to the continent he mingled with men of high

CHAUCER READING HIS POETRY AT THE COURT OF EDWARD III

It would be pleasant to know that such a scene as this actually took place We have no record, however, that the King knew Chaucer in any capacity other than that of public official This painting, by the English artist Ford Madox Brown, now hangs in the National Art Gallery at Sydney

estate directing national and international affairs. In Italy he may have known Petrarch and Boccaccio. At home he was a friend of the poet Gower, and he must have met the historian Froissart, who was at the English court when he himself was there.

From the day when he flashes before us, a page in red and black hose, Chaucer knew the noble way and the royal way of living. From his experiences as soldier he was acquainted with hardship on the field, and, at least once, he knew the misery of imprisonment in a foreign land. Familiar with the practises of chivalry, he satirized them as dying customs.

PILGRIMS ON THEIR WAY TO CANTERBURY

This lively old picture shows us a group of pilgrims such as Chaucer had in mind when he wrote his 'Canterbury Tales'. Notice the medieval walled town they are passing. The picture is from a manuscript of a later Canterbury Tale written by John Lydgate about 1430.

His knowledge of men, broadened by travel, was deepened by work at home. Controller of the customs in London, he daily met all manner of folk, native and foreign, clustering about the quay. There were customs evaders even then; he called them to account. Deputy forester, he met cottagers of Somerset. Knight of the Shire for Kent, he sat with parliamentarians. As clerk of the king's works in charge of repairing royal residences and state buildings, he supervised carpenters and masons. He knew all classes; he saw all with clear-eyed vision, with humorous recognition of their foibles, and with sympathetic appreciation of their fineness.

Poet of humanity, he was necessarily a poet of love. His 'Troilus and Criseyde', in some respects his supreme accomplishment, is a perennially great love story and rightly has been termed the first English novel, though it is in verse. To be the poet of love, he needed to know, and he knew, women. Queen, duchess, nun, middle-class woman, lower-class woman, woman of whatever rank, Chaucer faithfully portrayed. His ladies of high station may be somewhat conventional; but those of lower level, for example, the Wife of Bath, are vigorously realistic.

Chaucer was, it is often remarked, a lucky man. Well-born, received early into noble and royal households, favorite of kings who gave him well-paid posts, he enjoyed life, for the most part, in genial fellowship with his peers, and so passed his days in serenity of spirit. He was, perhaps, not a good manager of his purse. Though he enjoyed comfortable salaries, he seems frequently to have been in need of ready money. On diplomatic missions, though later reimbursed by the king, he sometimes exceeded his allowance for expenses. When as clerk of the works, he carried large sums for paying off the laborers, he was robbed two or three times; once he was severely beaten.

For the 12 years (1374–86) that he was controller of the customs, Chaucer and his wife lived in a house built above Aldgate, one of the gates in the city wall. Toward the end of 1386 he may have lived in Kent, which he was elected to represent in Parliament that year. Nothing is known about his place of residence again until December 1399, when he leased a house, less than a year before his death in the garden of Westminster Abbey. He was buried in the abbey because he lived there. In later years other men of letters were buried near him and so his tomb became the nucleus of the famous Poet's Corner.

Chaucer's Influence on the Language

Five or six centuries ago when there were no printed books and contacts between various parts of England were few, there were striking differences in the English language as spoken in different regions (*see* English Language). Furthermore, the language of the Court was French, and the language of learning was Latin. Chaucer played an important part in developing the English language. First, he was the first great writer to use the native tongue instead of French or Latin. Second, he used the English of London and thus helped to establish the English of the Midland counties, rather than the Northern or the Southern dialects, as the standard form.

Chief Works and Editions

Exact dates cannot be assigned to Chaucer's various works since they were not "published" in the modern sense. The following list gives the approximate dates of composition: 'The Book of the Duchess' (1369–70); 'The House of Fame' (1372–80); 'The Parliament of Birds' (1380); 'Troilus and Criseyde' (1380–86); 'The Legend of Good Women' (1385–86); the Prologue and earlier written 'Canterbury Tales' (1387–92); later written 'Canterbury Tales' (1393–1400).

For general reading these one-volume editions are recommended: 'The Student's Chaucer', edited by W. W. Skeat (Oxford, 1929); 'Poetical Works', edited by F. N. Robinson (Houghton, 1947). The best edition is 'Complete Works', edited by W. W. Skeat, 7v. (Oxford, 1894–97). 'The Book of Troilus and Criseyde', edited by R. K. Root (Princeton Univ. Press, 1926) is the definitive text of this poem.

For high-school students there are F. E. Hill's translation of 'Canterbury Tales' into modern English verse (Heritage, 1946); and 'The Modern Reader's Chaucer', in prose by J. S. P. Tatlock and Percy MacKaye (Macmillan, 1912). For younger readers: 'Story of the Canterbury Pilgrims', by F. J. H. Darton (Lippincott, 1914); 'Tales from Chaucer', by Eleanor Farjeon (Branford, 1930). Books about Chaucer: 'Geoffrey Chaucer of England' by M. G. Chute (Dutton, 1946) and 'Chaucer's World', compiled by Edith Rickert and edited by C. C. Olson and M. M. Crow (Col. Univ. Press, 1948)

Chaucer's Greatest Work, the 'Canterbury Tales'

HARRY Bailly s Tabard Inn in Southwark across the Thames from London was a place where pilgrims to Canterbury liked to spend the night before an early start next morning In spring and summer it was always crowded, for the people of 14th-century England loved to make pilgrimages to the shrines of their favorite saints and of these pleasant holiday excursions none was more popular than the one to the shrine of St Thomas Becket at Canterbury (See Becket Thomas Canterbury Pilgrims)

The Prioress

On the evening of Apr 16 1387 Chaucer brings together at the Tabard Inn a famous company of pilgrims of various occupations and ranks *The Prologue tells us that there* were 29 in all but then introduces 30 not counting Chaucer There were a Knight and his young son a Squire the Knight s Yeoman (servant) a Nun or Prioress with her three priests and a Second Nun a Monk and a Friar a Merchant a Clerk (scholar) of Oxford a Sergeant of Law (lawyer) a Franklin or country gentleman There were a group of well to-do tradesmen—a Haberdasher a Carpenter a Dyer a Weaver and a Tapestry Maker a Cook a Shipman (sailor) a Doctor of Physic a Wife (woman) of Bath a Parson (parish priest) and his brother a Plowman There were a Miller a Manciple (steward) a Reeve (superintendent of an estate) a Summoner (court officer) and a Pardoner (seller of indulgences) And there was Chaucer himself

And the Knight

A jolly fellow with an eye to business Harry the Host offered a plan of entertainment every man and woman should tell two tales going to Canterbury and two returning The one who told the best tale should have a supper at the expense of the others All approved the plan asking Harry to be judge

The First Day

At daybreak next morning the party set out and Harry had them draw lots to determine who should begin The shortest lot fell to the Knight who told the classical romance of Palamon and Arcite and their tragic rivalry for the love of Emily When the Knight had finished his noble tale the miller who was drowned in ale followed with a coarsely humorous *fabliau* about a reeve The Reeve immediately got even with a *fabliau* about a miller The Cook began a little jape about an apprentice but did not get very far Chaucer probably recognized that three broadly humorous tales in succession would be inartistic moreover the company was drawing up at the Dartford inn

The Second Day

Next morning at ten o clock after a late start Harry called upon the Man of Law who contributed the virtue story of Constance emphasizing constancy under misfortune In his enthusiasm at the close of this profitable tale the Host stood up in his stirrups and cried with an oath for a story by the Parson Upon being reproved for swearing he acidly retorted that doubtless now they would all get a sermon The Shipman *declaring that the Parson should do no preaching* broke in with a *fabliau* about a merchant s wife and a monk Harry then turned to the Prioress who sobered the pilgrims with the miracle tale of the little clergeon (choir boy) who was murdered but continued to sing after death Feeling the need of something gay Harry now addressed Chaucer You have as well shaped a waist as I have says Harry jokingly and remarks on Chaucer s fair face and his abstracted look Chaucer then tells the tedious Tale of Sir Thopas brilliantly burlesquing the popular metrical romance but he is cut short by the Host whose ears ache from such doggerel Protesting that he should have another chance Chaucer tries again and for two hours without interruption spins out a dull sermon in prose about Melibeus and his wife Prudence

The Clerk

After wishing his wife had heard of patient Prudence the Host called upon the Monk who presented 16 examples of tragedy of men fallen from high to low estate Beginning with Lucifer and Adam he had got as far as Croesus when Harry declared they had all had enough It would be more joyful he said to hear of men who had climbed from poor estate to good fortune He begged for a hunting story but the Monk was in no mood for that kind of thing let someone else continue Sir John the Nun s Priest told with high art the beast epic of chanticleer his hens and a fox and was commended by all the company By this time they had arrived at Rochester

The Third Day

Next morning the Physician led off with the tragedy of Virginius who slew his daughter Virginia rather than surrender her to wicked Appius At the close

THE MARRIAGE OF PATIENT GRISELDA, ONE OF CHAUCER'S HEROINES

The story of Griselda, which is told by the Clerk of Oxford, was a great favorite in the Middle Ages. Its theme is the humility and obedience of Griselda, who bore submissively the cruel tests imposed by her noble husband, the Marquis of Saluces, never murmuring even when he robbed her of her children and pretended that he was taking another wife. The picture above is one of a series depicting the Griselda story, done by some unknown Italian painter of about Chaucer's time. (*National Gallery, London*)

Harry needed a draught of ale to cheer him, as well as a merry tale, which he asked the Pardoner to tell. "Nay!" cried the gentlefolk. "Let him tell no kind of ribaldry, but something moral to improve the mind." So the Pardoner, after refreshing himself at a near-by ale-house preached a sermon in verse on greed, exemplifying his text with the classic story of three men who killed one another for the treasure they had discovered. He and the Host fell into dispute but the Knight intervened to end their quarrel.

Alice, the Wife of Bath, after a long entertaining prologue about her marital affairs, contributed a romance or fairy tale of the days of King Arthur. For laughing at her long preamble, the Friar was reproved by the Summoner; the two had angry words, ending with each telling *fabliaux* against the other's profession. The Host established peace as the pilgrims drew near Sittingbourne.

In the afternoon the Clerk of Oxford, who had been riding along quietly, responded to Harry's request with the "virtue story" of Patient Griselda, which he said he had learned from Petrarch. Again, the Host wished his wife had heard of such patience, and the Merchant bewailed that though married only two months he had found his wife a cursed shrew; if he were free again, he would never be snared. He went on, appropriately, with the tale of old January and young May, a combined *fabliau* and fairy story.

The Fourth Day

After the night at Ospringe, the Squire began the oriental romance of Cambuscan, King of Tartary, his daughter Canace, the magic ring, and the flying horse. If it had been finished, this would have been one of the longest, finest tales; many writers since Chaucer have tried their hands at its completion. Praising the story, and wishing that his own son were like the Squire, a lad of discretion rather than one who played dice and took no heed of good counsel, the Franklin told a story of love and magic, of the type called a *lai*. The Second Nun then related a "miracle tale" based on the chief events in the life of St. Cecilia. As the Nun finished, a Canon and his Yeoman dashed up on sweating horses, hurrying to overtake the pilgrims and ride with them. In answer to the Host's questions, the Yeoman revealed that his master was an alchemist, who could pave with gold and silver the road to Canterbury. Vexed that his secrets were told, the Canon fled and the Canon's Yeoman then told in rhyme a tale about the tricks of alchemists.

Here the Cook, sleepy from too much drink, was called on; but he declared he would rather sleep than drink the best gallon of wine. The Manciple called him a drunken lout and offered to take his place, contributing a *pourquoi* story, or fable: Why the crow became black. Finally the Parson, at four in the afternoon, began a prose sermon on the seven deadly sins, ending the sermon and the series in sight of the cathedral spires of Canterbury.

The pilgrims had beguiled the way with instances of the chief kinds of narrative known to the Middle Ages: classic romance, oriental romance, Arthurian romance, classical tale, saint's life, miracle tale, virtue story, *fabliau*, beast epic, *exemplum*, *pourquoi* story, *lai*, fairy story, burlesque of romance, and contemporary tale; all these besides three sermons. No tale was adjudged the best; but readers may decide for themselves, as readers have done for five and a half centuries. Twenty complete tales were told; four were left incomplete. If the original plan had been followed, there would have been 120. Twenty are ample, "God's plenty," to reveal Chaucer's skill in realistic description and consummate narrative, his glowing imagination, the breadth and depth of his humor.

About 90 manuscripts of the 'Canterbury Tales' exist, complete or incomplete. Of these the best is the Ellesmere Manuscript, from which the illustrations on the preceding page are taken. Caxton first printed the Tales (about 1478), but not from the best scripts, and since his time many editors have published many editions.

CHAUTAUQUA (*shă-tą'kwą*) Each summer men and women from all parts of the United States eagerly gather at the Chautauqua Institution for entertainment and study. This pioneer institute of adult education is beautifully situated on the wooded slopes of Lake Chautauqua in western New York State In a single season it has attracted more than 150,000 persons. In the ten-week session, courses are given in such subjects as music, library training, education theater, arts and crafts and physical education and there are children's classes and a summer high school Since 1923 the School of Education of New York University has given courses there with college credit

Symphony orchestras and opera and drama groups provide entertainment in the huge open-air theater and noted speakers lecture on varied subjects of world wide and community interest Chautauqua is equipped with its own hotels, cottages, lodging houses class buildings, and athletic fields The extensive property is valued at more than $1,000,000

The Chautauqua Institution was originally founded to provide training for Sunday School teachers In 1874 John Heyl Vincent, editor of the *Sunday School Journal* and later a bishop of the Methodist Episcopal church, and Lewis Miller, a manufacturer of Akron, Ohio, organized a summer class, which met at Fair Point on Lake Chautauqua The name of the meeting place was soon changed to Chautauqua

Chautauqua was one of the first institutions to offer summer study. Interest was so great that by 1879 instruction was being given in foreign languages and education methods and after that Chautauqua expanded rapidly, adding courses in many different fields of knowledge In 1878, a Chautauqua Literary and Scientific Circle was established, offering a four-year home reading course directed by correspondence

The institution chartered a School of Theology in 1881 and a Chautauqua University in 1883 The university gave instruction both in the summer assembly and by correspondence and had power to confer degrees About 1890 university extension work, which had originated in England, was introduced These projects all flourished for a short time, but were eventually abandoned in favor of the original plan of summer assemblies giving general cultural and teacher-training courses

The sweeping success of Chautauqua inspired many communities to organize similar summer study meetings, but few of these have survived More successful were the "circuit" or traveling "chautauquas" which visited small towns They were not connected with the Chautauqua Institution, however, and their chief purpose was to provide entertainment They presented music, lectures, and plays in tents When introduction of the automobile, motion picture, and radio made a greater variety of entertainment available to people in small communities the traveling chautauquas rapidly declined

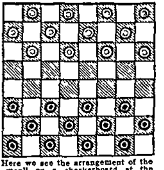
An important forerunner of the Chautauqua was the "lyceum" Early in the 19th century Josiah Holbrook of Derby Conn a popular lecturer encouraged groups to meet for lectures and discussion His aim was to organize an international movement for mutual instruction "each unit of which would be called a lyceum from the place where Aristotle lectured to the young men of Greece

Although no international organization was founded, the movement spread quickly through the United States The first lyceum was founded in Millbury Mass, in 1826 and by 1834 there were nearly 3 000 lyceums in the country Many of them engaged such noted lecturers as Emerson Holmes, Lowell, Thoreau and Beecher

Until the Civil War when the lyceum declined these lecture-discussion groups represented the most ambitious effort to develop the intellectual life of the nation Modern lyceums are organized merely for entertainment

CHECKERS Battles between checker men" have interested young and old ever since the first crude game of draughts was played by the Egyptians —probably as early as 1600 B C Later the Greeks and Romans enjoyed the game and more recently there have been French, German, Polish, Dutch Scotch, and English games of "draughts," the latter being the game called "checkers" in America

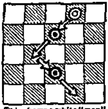
The game is played with small round pieces of wood or bone arranged in lines of battle on a square board, divided into 64 alternating squares of black and white or black and red Two players using a set of 12 "men" each direct the combat, which consists in an orderly advance and retreat across the battlefield The men of one player are colored white (or red), the other black The object of the game is to capture your opponent's men and remove them from the board



Here we see the arrangement of the "men" on a checkerboard at the beginning of a game

The forces are drawn up on the first three rows of the black squares on opposite sides of the field, as in diagram 1 Each side moves alternately, and the men may only be moved forward diagonally, to the right or left, to the next unoccupied black square

When the adjoining square is occupied by one of the enemy and the square next in line is vacant, the player must "jump" his man over his opponent's piece to the vacant square, and remove the enemy's man from the board Sometimes two or more jumps can be made by a single move (see diagram 2) When a man has penetrated to the last or "king" row of the enemy's line, it becomes a "king" (indicated by placing another checker on top of it) A king can



This shows a white "man" taking two of his opponents by jumping over them in the way indicated by the arrows

move either forward or backward, but still only on the squares of the color being used. A player wins by either capturing all the opponent's men or blocking them so they cannot move without being taken.

CHEESE. Legend tells us that an Arab journeying across the desert was disappointed at noontime when he opened the calf stomach in which he had carried his milk, to find that the milk had changed to a curdy mass, floating in an almost clear liquor. But, when he tasted the curdy mass, he found it delicious. If the legend is true, the calf stomach was imperfectly dried and hence contained *rennet*, a digestive ferment which curds milk; and thus the Arab unwittingly invented cheese making.

The Arab story may be a fiction; but undoubtedly in some such way men learned, early in history, how to condense the food substance in milk into the solid, easily carried form of cheese.

All cheese making starts with coagulation of the casein, or milk protein, together with the butter fat and other solid matter. The coagulating may be accomplished by adding rennet, by letting lactic acid bacteria "sour" the milk through changing its milk sugar (lactose) to lactic acid, or by a combination of these methods. The liquid whey left after the solids are curded is drawn off; the curd is worked over according to the kind of cheese being made; and finally the cheese is stored to ripen. Ripening is accomplished by various bacteria, molds, or both.

Variations in this general process, and in the milk used—cow's, sheep's, or goat's milk—account for the tremendous array of cheeses known to the world. The pictures on the opposite page show the general process as used in making "American" or "American cheddar" cheese, sometimes called "store cheese." This cheese is named for Cheddar, England, where the process was first standardized. Cheshire cheese is similar, except that it develops a blue-green mold.

Superb Food Values in Cheese

Various misunderstandings have kept many people from utilizing the fine food values of cheese, particularly the notion that cheese is indigestible. Actually it is 90 to 99 per cent digestible; the real cause of the trouble has been misuse. Cheese is a highly concentrated food; American cheese is about 24 per cent protein (more than twice the amount found weight for weight in fresh meat), and 32 per cent is butter fat. Half a pound of good American cheese contains all the protein and about half the calories of energy food needed by an adult for a day. People have lived for more than a year in perfect health on a diet of cheese, whole wheat bread, and fruit. When cheese is eaten in quantity, it should be the main reliance for protein and energy food; the rest of the meal should have plenty of "bulk" or "roughage" foods. The concentrated food value in cheese is evident when we know that 10 pounds (4.7 quarts) of whole milk are used in making one pound of American cheese.

Aside from its being such a concentrated food, cheese is especially valuable in the diet because it provides many food elements—particularly calcium (lime) needed for bones and teeth. Almost all the food value of milk, considered a nearly perfect food is preserved in cheese, except the milk sugar, albumin, and vitamin B. Most of the vitamin A is retained.

Modern Ways of Making Cheese

Until 1851 all cheese made in America was produced on farms and in homes. That year a cheese factory was started in New York, and the advantages of factory methods have practically ended home manufacture. The only cheese often made in the home now is "cottage cheese," the fresh curd of soured milk, which sometimes is mixed with cream or butter. The cheeses usually found on the market include about 20 types with some 400 varieties. Conditions are right for making some cheeses only in a few places or perhaps in a single place in the world.

Wisconsin produces about half of the total United States output. Other leading producers are New York, Illinois, Missouri, Minnesota, Tennessee, Ohio, and Indiana. Production annually totals about one billion pounds, excluding cottage cheese, from 9 per cent of the milk supply. Imports average about 22 million pounds. Cheese consumption is about seven pounds a year for each person.

Process cheese has grown in popularity since it was developed in 1915. It is a blend of natural cheeses of different types or ripeness. It is ground, mixed with water and an emulsifying agent, and heated. Heating halts further ripening, thus assuring uniform quality. Process cheese has a milder flavor than raw cheese and packages conveniently. Machines can cut and package it into sandwich-size slices. Cheese spreads are process cheese with milk or other food solids added. About 600 million pounds of process cheese, cheese spreads, and related products are manufactured each year.

Cheeses from Abroad

Roquefort, "king of cheeses," comes from Roquefort, France. It is ewes' milk cheese, hard, milk-white, and streaked with blue-green mold. This mold, a kind of *Penicillium*, grows from powdered bread mold sifted into the curd. Holes punched in the cheeses let oxygen reach the mold. The cheeses are placed for ripening in natural and artificial caves at Roquefort. Gentle breezes blowing through these vaulted caverns keep the damp air fresh and cool. Cheese makers in neighboring regions make blue cheeses with a *Penicillium* mold, but they generally use cows' milk. Cheese manufacturers in the United States produce similar cheeses, which they call *blue* cheese or "Roquefort type" cheese.

Other countries, however, make excellent mold-ripened cheeses. Among the best known are the Italian cow's-milk *Gorgonzola* and the English *Stilton*.

All these cheeses are of the hard type, with less than 40 per cent water in the finished product. Another noted hard cheese is the round *Edam* of Holland. It is made much as American is, except that the flavor is a trifle sweeter, and the outside is colored a bright red. *Goudas* are the same cheese, made flatter. The "jumbos" of the cheese world are the huge Swiss

SIX CHAPTERS IN THE LIFE OF A CHEESE

An American cheese starts life when a lactic acid starter rennet and coloring matter are mixed with the milk and stirred with large paddles When the cheese has curded properly workmen cut it into cubes with wire knives The third operation is "ditching" or piling the curd to each side of the vat until the whey drains off The ditched curd then is cheddared or piled in large slabs as shown in the fourth picture The process is repeated until the cheese acquires the proper body The slabs then are "milled" or shredded salted and pressed inside cheese-cloth lined hoops for about 18 hours The shaped cheese is then stored away to ripen Every step is controlled by chemical and other tests and temperatures are kept exact in order to obtain the quality desired

wheels weighing from 100 or 200 pounds to as much as a ton apiece They were first made in the valley of the Emmen River Switzerland and the product was known as *Emmenthaler* cheese but Wisconsin dairymen now produce great quantities of fine Swiss type' cheese The holes in Swiss cheese come from gas generated by bacteria during the ripening process Any departure from the proper shape and appearance of these holes is a sign of imperfect ripening *Gruyère* cheese originally made in the Swiss town of that name is similar to Emmenthaler *except for smaller holes*

The extremely hard cheeses which must be grated for use in flavoring soups and other dishes are a specialty of the Italians Perhaps the best known are the *Parmesan* types including the *Reggiano* originally made in north Italy the *Romano* types made near Rome and the extremely hard dry sharp-tasting *Caccio Cavallo* This cheese has less than 25 per cent water content

Perhaps the best known soft cheese is the kind originally made in the Norman village of *Camembert* It is made of cow s milk coagulated with rennet but the secret of making Camembert is the action of two kinds of bacteria working under the atmospheric conditions of Normandy to produce the rich flavor and buttery like softness of the finished product together with the 'nippy' rind French *Brie* is somewhat similar Dairymen in the Americas are successfully imitating this and many other foreign cheeses Next to cottage cheese the most familiar soft cheese is *Philadelphia Cream* made of soured cream salted and worked to buttery smoothness by machinery

A noted semi hard cheese is *Limburger* originally marketed in Limburg Belgium Bacterial ripening in proper surroundings creates the flavor and pungent ammoniacal odor Wisconsin makes fine Limburger cheese Similar cheeses with milder odor are *brick* and *Muenster* All are difficult to make because they must be turned by hand during the making and salted and washed several times *Port du Salut* also called Trappist and Oka and the Italian *Bel Paese* are semi hard

CHEMICAL WARFARE. "Let us rule the battle by means of the elements." This motto of the United States Army's chemical corps describes the aim of *chemical* warfare. It embraces the use of fire, smoke, and perhaps gas against an enemy (*see* Army).

One of the most effective chemical warfare weapons is fire in the form of incendiary bombs. Many of these bombs contain jellied gasoline or magnesium and Thermit (aluminum powder and oxide of iron). The chemical ignites when the bomb explodes. Another burning agent is white phosphorus, which is released from bombs, shells, and hand grenades.

The most destructive weapon in close combat is the flame thrower. It can shoot a stream of fire 50 yards or more. The burning agent is a liquid or jellied incendiary fuel mixed with compressed nitrogen.

Chemical smoke is used chiefly as a screen to hide ships and troop movements. Colored smoke, in the form of shells or grenades, is employed for signaling and to identify friendly units from the air or ground.

Gases Used for Warfare

Poisonous gases may kill enemy troops or cripple their effectiveness. The gases are classified as *lung irritants*, *vesicants* (blisterers), *lachrymators* (tear gases), *sternutators* (sneeze gases), and *incendiaries* (fire-producing chemicals). The most deadly are the vesicant gases—mustard, lewisite, and nitrogen mustards—and the lung irritants, such as chlorine, phosgene, and chloropicrin.

War gases may be released from cylinders and then carried to their objective by the wind; or they are hurled at an enemy by means of bombs or shells. Airplanes may also release gas from special tanks.

Protection Against Poison Gas

Many war gases can be identified by their characteristic odor. These are: mustard, garlic; lewisite, geraniums; phosgene, musty hay; and chloropicrin, flypaper. Nitrogen mustards have no odor. Gas masks give protection against most gases. The masks cover the face and guard the lungs by filtering out poisonous vapors from the air. The purifying agent in the filter is usually a mixture of soda lime impregnated with potassium permanganate, and nutshell charcoal.

Gases which attack the skin may be warded off by wearing protective clothing. The effect of a poison gas may be counteracted by an antidote, such as British anti-lewisite (BAL). This antidote is a complex alcohol which attracts the arsenic in lewisite away from enzymes in the body. BAL is applied to the skin in ointment form or is injected hypodermically in oil.

THE ARMY GAS MASK

The canister on the left cheek filters out poisonous vapors. Exhaled air is expelled through the flap under the nose.

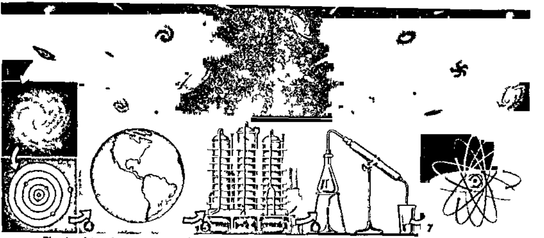
History of Gas Warfare

Poisonous and asphyxiating gases were used in the days of Byzantium and by the Saracens against the Crusaders of the 13th century. During the Civil War Union forces hurled Greek fire, generating poison gas, into Charleston. In 1907 a Hague convention forbade the use of poisons and arms which would cause unnecessary suffering.

Gas warfare began in the first World War at Ypres in 1915, when the Germans released chlorine gas in cylinders. Although both sides used gas, it caused less than 10 per cent of the war casualties. The Treaty of Versailles held that the use of poison gas was against international law, and the Washington Conference on the Limitation of Armaments (1922) confirmed this stand. Both Axis and Allied nations threatened to use gas in the second World War but did not carry out their threats.

FIRE AS A WEAPON OF WAR

A hand grenade weighing less than two pounds produced this shower of burning white phosphorus particles. Trained soldiers can hurl such a grenade for 40 yards or more. It is used as a smoke screen and for its incendiary effect on enemy personnel and installations.



The chemist studies matter everywhere—in the entire universe (1) in galaxies (2) in our solar system (3) and in the earth as a whole (4) On earth he helps with industrial processes (5) using laboratory findings (6) He knows that every change which involves matter anywhere depends upon the properties of atoms (7)

How CHEMISTRY *Makes* USEFUL CHANGES *in* MATTER

CHEMISTRY Chemistry is the science that tells us what the stuff in the world is made of and how this stuff is constructed Chemistry also tells us how to change or convert the things in the world into new things such as rubber nylon and plastics and to better our living by making stronger metals improving the soil or destroying bacteria

In general chemists make their contributions by taking substances apart and putting them together in different desired combinations Taking apart or *analysis* enables the chemist to learn what a substance is made of then by combining the parts (*synthesis*) they may produce a substance similar to the old one or a completely new substance

Today chemistry provides employment for a host of people in laboratories universities colleges and schools and in businesses where chemistry is used in a manufacturing process The chemical industry is now the greatest in the United States from the economic standpoint It now exceeds the great iron and steel industry in value of products

The 1950 census lists more than 100 000 people employed as chemists and chemical engineers Nearly 200 000 others are employed in manufacturing chemical products Other thousands teach chemistry A knowledge of chemistry is immensely helpful in a great number of occupations such as medicine agriculture and engineering Every well informed citizen should also know what chemistry can do for all of us in this scientific age

How Chemistry Helps Us to Understand Our World

The chemist wants to understand how our universe is put together and how he can change the substances in it to man s advantage Chemists (together with physicists) have greatly simplified these problems by their discovery that all things in the universe can be classified as matter and energy and also that matter and energy can be converted from one to the other (*see* Energy Matter) A further simplification is made by classifying matter according to its physical state or according to its composition

MATTER

(Physical State)	(Composition)
Solids	Elementary substances (called elements)
Liquids	Compounds
Gases	Mixtures

A study of solids liquids and gases led to the conclusion that the behavior of these three forms of matter could be explained satisfactorily by assuming that matter is made of particles in motion This moving particle theory (called the *kinetic molecular theory of matter*) explains many common phenomena such as evaporation of liquids diffusion of gases and crystal patterns of solids (*See also* Heat)

A study of elements has helped further in learning about the universe because chemists have found that the whole universe is made up of about 100 elements Hence the science of chemistry involves a study of these elements and of the substances (compounds) which are formed when they combine Chemists now know the composition of about 700 000 compounds

How Elements Are Made of Atoms

Today s chemists also know that elements are made of tiny building blocks called *atoms* Some early Greek philosophers proposed that matter was made of atoms but they performed no experiments to prove this Now we have much evidence that matter is made of atoms Some of this evidence is as follows

1 Chemists have discovered that every pure substance has a definite composition This fact is called the Law of Definite Composition

2 Sometimes two elements such as oxygen and hydrogen combine to form two different kinds of sub-

NEW KNOWLEDGE FROM A LABORATORY

This research chemist is using an elaborate array of stills, as part of his efforts to discover new knowledge about a chemical problem. His findings may provide the basis for a new industry.

stances. For example, hydrogen (H) and oxygen (O) form water (H_2O) and hydrogen peroxide (H_2O_2). In all such cases the elements combine in the ratio of whole numbers which are usually small.

Observations such as these can be explained easily if we assume that all matter is made of atoms. The atomic theory can be stated as follows.

1. Matter is made of small particles called atoms.
2. Atoms of the same elements have the same average masses, but atoms of different elements have different average masses.
3. Chemical reactions take place between atoms or groups of atoms.

We can define an *element* as a substance made of one type of atom only. For example, copper is made of copper atoms; oxygen is made of oxygen atoms.

Elements combine to form compounds and thus change properties of the original elements. For example, carbon reacts with oxygen to form carbon dioxide. This is called a *chemical* change.

Types of Changes in Matter

Matter can undergo three kinds of changes: chemical, physical, and nuclear. When we burn gasoline, electrolyze water, or produce rubber or plastics from petroleum we make chemical changes. In each case, the original atoms are preserved, but the new substance has a different chemical composition from the original material. The atoms have been rearranged into new combinations.

Breaking glass, tearing cloth, boiling water, freezing water, and distilling alcohol are all examples of *physical* changes. In all these reactions the chemical composition of the substances involved remains the same. The only change is in physical form.

The phenomenon of radioactivity, the fission of uranium 235, or the fusion of hydrogen atoms (to helium atoms) with the resultant release of atomic energy are examples of *nuclear* changes. In each case the composition of the nuclei of the atoms has changed and one kind of atom is transmuted into another.

Tendency of Elements to Combine

Elements, like people, have a wide range of characteristics. They vary from those that are very active to those that are completely inert (unreactive). The tendency of substances to react or combine is called a chemical property.

In many cases atoms of the same substances combine with each other to form molecules. For example, atoms of oxygen, hydrogen, nitrogen (N) and chlorine (Cl) form the molecules O_2, H_2, N_2, and Cl_2 respectively. A few elements, such as helium, neon, argon, krypton, xenon, and radon, are inert.

Atoms of most elements will react with other kinds of atoms to form compounds. Even in the combined states, atoms may still react. For example, an atom of iron (Fe) reacts with the oxygen in a water molecule (H_2O) and robs the water of its oxygen atom. The reaction produces a molecule of rust (iron oxide, FeO) and a molecule of hydrogen (H_2).

Compounds and Mixtures

This tendency of atoms to combine with atoms of different elements makes it possible to have a great variety of new substances called *compounds*. Such substances as water, sugar, and Dry Ice are compounds. A compound is made of two or more elements that have undergone a chemical change; hence a compound is composed of two or more different kinds of atoms. The grouping of atoms needed to provide a given unit of a compound is called a *molecule*. In most cases, a molecule has chemical characteristics different from those of the atoms which make up the molecule.

A molecule can also be defined as two or more atoms in chemical combination. They may be the same or different atoms. For example, the elements hydrogen and chlorine combine to form the compound called hydrochloric acid (HCl). Chlorine will combine with carbon to form the cleaning fluid, carbon tetrachloride (CCl_4).

Such substances as milk, paint, and muddy water are *mixtures*. In contrast to compounds, mixtures have not undergone a chemical change. Neither do mixtures have definite composition; hence their composition cannot be shown by a fixed formula. Furthermore, they can usually be separated by physical methods such as distillation, crystallization, or solution. For example, mixed sulfur and iron filings

SIMPLE SYMBOLS FOR CHEMICAL ELEMENTS

SYMBOLS FROM COMMON NAMES

NAME	SYMBOL	NAME	SYMBOL	NAME	SYMBOL
Aluminum	Al	Fluorine	F	Nitrogen	N
Argon	A	Helium	He	Phosphorus	P
Beryllium	Be	Lithium	Li	Platinum	Pt
Boron	B	Magnesium	Mg	Silicon	Si
Calcium	Ca	Manganese	Mn	Sulfur	S
Carbon	C	Neon	Ne		

SYMBOLS FROM LATIN NAMES

COMMON NAME	SYMBOL	LATIN NAME	COMMON NAME	SYMBOL	LATIN NAME
Antimony	Sb	Stibium	Mercury	Hg	Hydrargyrum
Copper	Cu	Cuprum	Potassium	K	Kalium
Gold	Au	Aurum	Silver	Ag	Argentum
Iron	Fe	Ferrum	Sodium	Na	Natrium
Lead	Pb	Plumbum	Tin	Sn	Stannum

These symbols are used for chemical shorthand. A list of all the elements is given on a later page.

can be separated by using a magnet to draw out the filings or by dissolving the sulfur with carbon disulfide and pouring off the solution.

Symbols for Elements. Formulas for Compounds

The name of an element is commonly indicated with an abbreviation called a chemical *symbol*. Many have already been used in this article. Some of them are the initials or first two letters of the common name of the element. Others are taken from the Latin name. Some of the common elements and their symbols are listed in a table on this page.

A symbol may not only represent the *name* of an element; chemists also use it to signify one *atom* of the element. A molecule composed of the same kind of atoms is indicated by a number which shows the number of atoms; thus H_2 is a molecule of hydrogen. The formula tells us that two atoms of hydrogen are required to make up one molecule of hydrogen. Similarly the formula for a molecule of oxygen is O_2. Since most elements (other than the inert gases) exist in the pure state as molecules rather than as atoms, the molecular formula is always very important in statements of chemical reactions. (The names and symbols for all the known elements are listed on a later page of this article.)

Just as chemists represent the names of elements with chemical symbols, so do they represent the names of compounds with a collection of symbols which is called a *formula*. For example, the formula for water is H_2O. A chemical formula shows both the number and the kind of atoms in a molecule of a compound.

Not only does the chemist use "shorthand" for the names of elements and the elements which enter into compounds, but he also uses symbols and formulas to indicate chemical changes (reactions). For example:

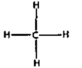
Word equation: Hydrogen reacts with oxygen to form water.

Symbol equation: $2H_2 + O_2 \longrightarrow 2H_2O$

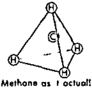
Word equation: Carbon burns in oxygen to form carbon dioxide.

Symbol equation: $C + O_2 \longrightarrow CO_2$

One precaution must always be kept in mind in using chemical formulas. Formulas are necessarily printed flat on a page, but compounds actually exist in three dimensions in space. For example, the compound methane (marsh gas, also called fire damp in coal mines) can be written in formula form as CH_4. This would suggest that the four H atoms are arranged in a circle around the central C atom. Actually the H atoms are arrayed at equal distances and angles which form a *tetrahedron*, or four-surfaced pyramid (including the base), with the C atom in the center of the molecule and the H atoms at the corners. In many chemical problems (such as contriving new plastics, for example) a chemist must think of the actual shapes in space of the molecules which he intends to use in his reactions.



Methane as shown by structural formula

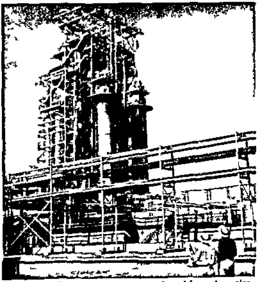


Methane as it actually exists in space

Atomic Dimensions and Weights

Atoms are about 1,000 times smaller than the smallest objects that can be seen with high-powered optical microscopes. To measure such tiny objects chemists use units that are more convenient than inches or centimeters. A common one is the Angstrom unit, written Å (1Å = 0.000 000 01 centimeters). Hydrogen atoms are the smallest; they are about one Angstrom unit in diameter. The largest atoms are those of the heavy alkali metals; they are about 5 Å units in diameter. (In science, sizes and weights are com-

CHEMISTRY SUPPORTS AN INDUSTRY



This plant produces styrene, a compound used for making plastics and synthetic rubber. Styrene is among the most important raw materials which chemistry makes synthetically.

monly stated in centimeters and grams, since the metric system of measurements is universally used.)

Atoms are not only very small in size, but their weight is also very small. An atom of oxygen weighs 0.000,000.000,000,000,000,000,027 grams. Such a number is very awkward to use. To obtain a simpler way of expressing the weights of atoms, the chemist chooses a *standard of reference*, the weight of an oxygen atom. He takes 1/16th of this weight as his unit, and he calls it the *atomic weight unit* (a.w.u.). The weight of each kind of atom, expressed in these units, is called an *atomic weight*. For example, the atomic weight of one atom of oxygen in a.w.u.'s is 16.

Atomic weights can also be expressed in grams. However, 16 grams of oxygen is the weight of much more than one atom of oxygen. It is the weight of 6.02×10^{23} atoms of oxygen. Atomic weights expressed in grams are called *gram-atomic weights*. They are the weight in grams of 6.02×10^{23} atoms of the element. The number 6.02×10^{23} is called Avogadro's number. "10^{23}" means 1 followed by 23 zeros, or a billion billion times 10,000. (*See also* Gas.)

How Elements Form Groups, or Families

The problem of learning about the things in the universe is still further simplified by classifying the elements in families, such as the halogen family, the alkali family, the nitrogen family, and so on. This was first done in 1869 for the elements then known by the Russian chemist Dmitri Mendeléev.

Today the lighter elements can be placed in a table according to their properties as follows:

Period	H							He
Period	Li	Be	B	C	N	O	F	Ne
Period	Na	Mg	Al	Si	P	S	Cl	A
Period	K	Ca						

All elements in the same vertical row have similar chemical properties. This indicates that the elements do not change properties *gradually* through the entire list from hydrogen to calcium, in keeping with gradual increase in atomic weights. Rather, the properties change gradually through a certain number of elements, called a *period* of elements. Then they *recur*, or *repeat*, through the next period. This is like the seasons recurring, or repeating, from year to year.

WHAT IT TAKES TO MEASURE AN ATOM

One unit of measurement, the foot, supposedly was taken from the size of a king's foot (1). For convenience, the foot is subdivided into inches (2). A powerful microscope can reveal dimensions to 1/125,000 of an inch (3); but it is still far from being powerful enough to measure an atom. For this, elaborate apparatus is needed (4), because one commonly used unit of measurement (the Angstrom unit) amounts to only about four billionths of an inch.

At the time of Mendeléev's work, a German chemist (Meyer) also noticed this recurrence of chemical properties, and he stated his findings thus: The properties of the elements are periodic functions of the atomic weights. This statement is called the *periodic law*, and a table of elements arranged according to it is a *Periodic Table*. The diagram on the following page shows the first 20 elements so arranged. (In that diagram the last column of table at left is shown first.)

Atomic Structures That Determine Properties

The ability to group elements in families and periods arises from the way in which the different kinds of atoms are made up of electrified particles. At the heart of each atom is a core called a *nucleus*, which contains one or more unit quantities of positive electric charge. The number of charges varies from one in the lightest element (hydrogen) to 20 in the heaviest element (calcium) shown in the diagram as indicated by numbers on the nuclei.

We now know that the periodic law should be expressed in terms of the number of unit charges on the nucleus of an atom rather than in terms of its atomic weight. The number of charges is called the *atomic number* (*see* Atoms). The atomic number was first devised by Henry Moseley in 1912. He arranged the elements according to the kind of X rays they produced and numbered the elements in this order. He called these numbers the atomic numbers. Later, Ernest Rutherford showed that atomic numbers are really the positive charges in the nuclei of the atoms.

In an atom, the nucleus is surrounded by negatively charged electrons equal in number to the atomic number. The electrons are arranged in layers or shells, as shown in the diagrams on the next page.

A common and convenient way of showing electrons consists of using dots around the chemical symbol for an element. The elements in the first row of eight in the diagram can be shown as follows:

O	I	II	III	IV	V	VI	VII
·He·	Li·	·Be·	·B·	·C·	·N·	·O·	·F:

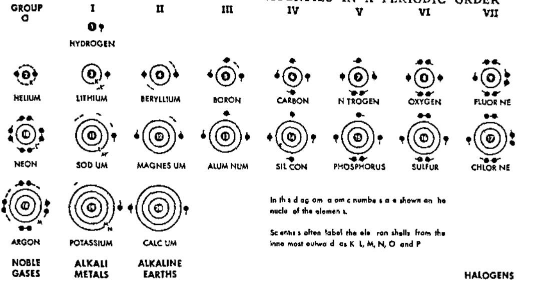
Usually the outermost shell only is shown, since this is the shell which causes chemical activity.

How Electrons Provide Chemical Properties

The chemical behavior of each kind of atom is determined by the outermost shells (or in heavier atoms two shells) of electrons only. (For reasons, *see* Matter.) If the outermost shell has two or eight electrons all electrical forces within the atoms are satisfied. There is nothing "left over" to make the atom interact readily with other atoms, and atoms with such outer shells are chemically inert. The inert atoms among those shown are helium (two electrons), and neon and argon (eight electrons each).

Atoms with incomplete outer shells seek to attain such shells in any way they can. Therefore atoms

WHY ELEMENTS REPEAT THEIR PROPERTIES IN A PERIODIC ORDER



This diagram shows how periodicity of chemical properties arises from electron arrangements within the atoms of the elements. In each vertical row or group except the noble gases in Group 0 the number of outer electrons is the same. Therefore the elements in each group have similar chemical properties and constitute a chemical family. Some families have common names as shown at the bottom of the diagram. (Here only the first 20 elements are shown.)

that have the same number of electrons in the outer shell have similar chemical properties since their methods of attaining complete outer shells must be much the same. Since the shells of the lighter elements gradually fill up to eight electrons and then start a new shell we can understand why the periodic or recurring properties appear.

How Can the Periodic Table Be Used?

The Periodic Table provides an easy way to show the division of the elements into acid forming and base-forming types. Those on the left are base forming, those on the right are acid forming (*see* Acids and Alkalies). Those in between can be either acid forming or base forming. Hence their hydroxides (combinations with OH ions) are called *amphoteric*. Examples of amphoteric hydroxides are those of beryllium—Be $(OH)_2$—and aluminum—Al $(OH)_3$.

The periodic arrangement also makes clear the important division of the elements into *metallic* and *nonmetallic* kinds. We usually distinguish between metals and nonmetals by their physical and chemical properties as follows

METALS	NONMETALS
Physical Properties	
Metallic luster	Various appearances
High conductivity for heat and electricity	Low conductivity for heat and electricity
Ductile	Nonductile
Malleable	Nonmalleable
Chemical Properties	
Form basic solutions	Form acidic solutions
Form positive ions in solutions	Form negative ions in solutions

Of the elements shown in the diagram above lithium, beryllium, sodium, magnesium and aluminum are metallic. The others are nonmetallic. The complete list is shown in another article, Periodic Table.

Finally the Periodic Table groups elements into chemical families. For example Group 0 of the elements shown above contains helium, neon and argon. These form the family of inert elements called *noble gases*. (In many tables this group is VIII instead of 0.) In Group I are hydrogen, lithium, sodium and potassium. Except for the gas hydrogen these are soft active substances which act chemically like metals in many ways. They react with water to form alkaline solutions. Because of these properties they are known as *alkali metals*. Next to them in Group II is the family of elements known as the *alkaline earths*. In Group VII are the *halogens*, fluorine and chlorine. (The word halogen comes from Greek terms meaning salt makers.) These elements are nonmetallic. Their compounds with hydrogen (HF and HCl) dissolve in water to form acids.

Many atoms that have a greater atomic number than 20 (calcium) show complicated structures due to inner shells of electrons filling to 18 and 32 electrons. Elements having atoms of this type appear in the Periodic Table as an inserted or *transition* group (not shown here) between Groups II and III. Electron structures of some elements such as chromium, iron and nickel give them properties that form colored solutions. The *transition elements* include the rare earth elements and the actinide series.

Atoms Gain, Lose or Share Electrons

Atoms that have a few electrons in the outer shell tend to lose them. This leaves them with a positive

NAMES AND SYMBOLS OF THE ELEMENTS

ELEMENT	SYMBOL	ATOMIC NO.	ATOMIC WT.	DENSITY
Actinium	Ac	89	227.	....
Aluminum	Al	13	26.98	2.699
Americium	Am	95	243.	....
Antimony	Sb	51	121.76	6.62
Argon	A	18	39.944	.00166
Arsenic	As	33	74.91	5.73
Astatine	At	85	211.	....
Barium	Ba	56	137.36	3.5
Berkelium	Bk	97	245.	....
Beryllium	Be	4	9.013	1.82
Bismuth	Bi	83	209.00	9.80
Boron	B	5	10.82	2.3
Bromine	Br	35	79.916	3.12
Cadmium	Cd	48	112.41	8.65
Calcium	Ca	20	40.08	1.55
Californium	Cf	98	246.	...
Carbon	C	6	12.010	2.22
Cerium	Ce	58	140.13	6.9
Cesium	Cs	55	132.91	1.9
Chlorine	Cl	17	35.457	1.51
Chromium	Cr	24	52.01	7.19
Cobalt	Co	27	58.94	8.9
Copper	Cu	29	63.54	8.96
Curium	Cm	96	243.	....
Dysprosium	Dy	66	162.46	(8.56)
Erbium	Er	68	167.2	(9.16)
Europium	Eu	63	152.0	(5.24)
Fluorine	F	9	19.00	1.14
Francium	Fr	87	223.0	....
Gadolinium	Gd	64	156.9	(7.95)
Gallium	Ga	31	69.72	5.91
Germanium	Ge	32	72.60	5.36
Gold	Au	79	197.2	19.32
Hafnium	Hf	72	178.6	11.4
Helium	He	2	4.003	.00017
Holmium	Ho	67	164.94	(10.12)
Hydrogen	H	1	1.0080	.00008
Indium	In	49	114.76	7.31
Iodine	I	53	126.91	4.93
Iridium	Ir	77	193.1	22.5
Iron	Fe	26	55.85	7.87
Krypton	Kr	36	83.80	.00349
Lanthanum	La	57	138.92	6.15
Lead	Pb	82	207.21	11.34
Lithium	Li	3	6.940	0.53
Lutetium	Lu	71	174.99	(9.74)
Magnesium	Mg	12	24.32	1.74
Manganese	Mn	25	54.93	7.43
Mercury	Hg	80	200.61	13.55
Molybdenum	Mo	42	95.95	10.2
Neodymium	Nd	60	144.27	7.05
Neon	Ne	10	20.183	.00084
Neptunium	Np	93	237.	....
Nickel	Ni	28	58.69	8.9
Niobium	Nb	41	92.91	8.57
Nitrogen	N	7	14.008	.00116
Osmium	Os	76	190.2	22.5
Oxygen	O	8	16.0000	.00133
Palladium	Pd	46	106.7	12.0
Phosphorus	P	15	30.975	1.82
Platinum	Pt	78	195.23	21.45
Plutonium	Pu	94	242.	....
Polonium	Po	84	210.	(9.24)
Potassium	K	19	39.100	0.86
Praseodymium	Pr	59	140.92	6.63
Promethium	Pm	61	145.	....
Protactinium	Pa	91	231.	....
Radium	Ra	88	226.05	5.0
Radon	Rn	86	222.	4.40
Rhenium	Re	75	186.31	20.
Rhodium	Rh	45	102.91	12.44
Rubidium	Rb	37	85.48	1.53
Ruthenium	Ru	44	101.7	12.2
Samarium	Sm	62	150.43	7.7
Scandium	Sc	21	44.96	2.5
Selenium	Se	34	78.96	4.81
Silicon	Si	14	28.09	2.33
Silver	Ag	47	107.880	10.49
Sodium	Na	11	22.997	0.97
Strontium	Sr	38	87.63	2.6
Sulfur	S	16	32.066	2.07
Tantalum	Ta	73	180.88	16.6
Technetium	Tc	43	99.	11.46
Tellurium	Te	52	127.61	6.24
Terbium	Tb	65	159.2	(8.33)
Thallium	Tl	81	204.4	11.85
Thorium	Th	90	232.12	11.5
Thulium	Tm	69	169.4	(9.35)
Tin	Sn	50	118.70	7.298
Titanium	Ti	22	47.90	4.54
Tungsten	W	74	183.92	19.3
Uranium	U	92	238.07	18.7
Vanadium	V	23	50.95	6.0
Xenon	Xe	54	131.3	.0055
Ytterbium	Yb	70	173.04	(7.01)
Yttrium	Y	39	88.92	5.51
Zinc	Zn	30	65.38	7.133
Zirconium	Zr	40	91.22	6.5

NOTE: This table contains the elements which are universally recognized. Discovery of elements 99 and 100 have been reported. Such discoveries are always subject to check by independent research, and the results and choice of names must be passed upon by an official reviewing authority before the elements are internationally accepted.

charge since the electrons are negative and their departure leaves a part of the atom's positive particles (protons) unneutralized. The metallic elements have atoms of this kind and for this reason are often called *electropositive elements*. Sodium is an example of this type of element. It has one outer electron and loss of the electron can be shown diagrammatically as follows

$$Na^{\ominus} \longrightarrow Na^{+} + {}^{\ominus}$$

The unneutralized positive charge left in the nucleus by the loss of the electron is shown by a + sign.

Atoms with almost enough electrons to complete an outer shell of eight tend to borrow the additional ones they need. Thus they acquire a negative charge. The nonmetallic elements are of this type and are called *electronegative elements*. Chlorine is an example of this kind of element.

$$Cl + {}^{\ominus} \longrightarrow Cl$$

The most active metallic atoms are those which need to lose only one or two electrons in order to empty their outermost shell and uncover the next full shell of eight electrons. Such losses occur because many electronegative atoms exert attractive force enough to overcome the electropositive atom's ability to hold its outside electrons. Similarly the most active nonmetals are those needing only one or two electrons to *fill* an outer shell with electrons.

Atoms with four or five outer electrons usually form compounds by sharing pairs of electrons with other atoms, each atom usually contributing one electron. (For an explanation of the sharing process *see* Matter.) The carbon atom with four outer electrons is a good example. Carbon forms compounds equally well *with a positive element such as hydrogen and* with a negative element such as chlorine. The reactions can be shown as follows

Formation of methane $\quad C + 4\,H \longrightarrow \begin{matrix} & H & \\ H & C & H \\ & H & \end{matrix}$

Formation of carbon tetrachloride $\quad C + 4\,Cl \longrightarrow \begin{matrix} & Cl & \\ Cl & C & Cl \\ & Cl & \end{matrix}$

In each case carbon shares eight electrons, hydrogen shares two and chlorine eight.

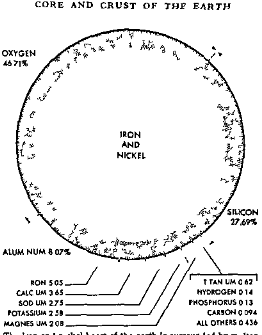
How Nuclei Form Isotopes

The outer electrons determine most of the chemical properties of atoms but differences in composition of nuclei affect the atomic weight and have slight effects on other properties. As explained in the article on Atoms each nucleus *is made up of particles* called *protons* and *neutrons*. A proton has a positive electric charge equal in amount to the negative charge on an electron and *in all atoms the number* of protons and electrons is always equal.

Neutrons have no charge. The number in a nucleus *can vary in atoms of the same element*. Such variations do not affect the electrons, the chemical properties or the atomic number. They simply affect the atomic weight of the nucleus (and therefore of the atom). Atoms of the same element which vary only in weight are called *isotopes*. Isotopes are like identical twins or triplets who have different weights. Some examples are given in the following table

ELEMENT	ATOMIC WEIGHTS	ELEMENT	ATOMIC WEIGHTS
Hydrogen	1 2 3	Oxygen	16 17 18
Carbon	*11 12 13 14*	Chlorine	*35* 36 37 38
Nitrogen	13 14 15	Uranium	234 235 238

CORE AND CRUST OF THE EARTH



The iron and nickel heart of the earth is surrounded by molten rock. The crust has elements in the percentages shown

Combining Power in Chemical Combinations

From earlier examples it is plain that atoms can join in various number combinations. Atoms of hydrogen and oxygen combine two and one as H_2O. Carbon and oxygen combine *one and two as CO_2* but hydrogen and carbon combine one and four as CH_4.

These examples suggest that hydrogen has a combining capacity of one, oxygen two and carbon four. The combining capacity of an element has often been *called its valence or valence number*. The power combining capacity is determined in combinations with elements having a valence of one (univalent elements). For example in compounds containing hydrogen the combining capacities of some other elements are as follows

COMPOUND	VALENCE NUMBER	NUMBER	VALENCE NUMBER
HCl	H 1 Cl 1	NH_3	H 1 N 3
H_2O	H 1 O 2	CH_4	H 1 C 4

The tendency of atoms to combine with each other apparently results from their tendency to form out-

side electron shells with eight electrons (except for light elements such as hydrogen and helium). As explained earlier in the article, such shells are called filled, or completed, shells. Atoms which have filled shells are in the most stable state possible.

Atoms can attain these stable configurations by either of two methods:

1. Sharing a pair of electrons; or
2. Gaining or losing electrons.

These methods can be illustrated with electron formulas as follows (ɵ or • means one electron):

Example 1 (sharing a pair): $\mathrm{H^{\theta} + {}_{\theta}H \rightarrow H:H}$

Example 2 (gaining and losing an electron): $\mathrm{Na^{\theta} + .\overset{..}{\underset{..}{Cl}}: \rightarrow Na^{+}:\overset{..}{\underset{..}{Cl}}:^{-}}$

In the first example, each hydrogen atom (H), taken by itself, has only one electron. The strong tendency shown by lone electrons to form pairs leads two atoms of hydrogen to do so with their electrons. The combination is a molecule of hydrogen (H_2).

In the second example the sodium atom loses its outermost electron to a chlorine atom which needs only one electron to complete its outer shell. The loss gives the sodium atom a stable configuration, because beneath the lost electron is a shell of eight others which becomes the outer shell. This process of loss and gain by transfer of an electron from one atom to another is called *ionization* and results in formation of *ions* (*see* Ions).

Meaning of Valence Numbers

The capacity of an atom to combine with others is determined by the number of electrons it gains or loses or by the number of pairs of electrons it shares. This combining capacity is also called the *valence number* of the elements.

Since many atoms react to form molecules by sharing pairs of electrons, chemists use a more precise term, *covalence*, to designate the combining capacity of elements by this process. Atoms also act to form ions by gaining or losing electrons, and chemists designate the combining capacity of elements which act in this way, by the term *electrovalence*. The electrovalence of an ion is the numerical value of the electrical charge on the ion.

Many kinds of atoms enter into compounds either by covalence or by electrovalence, depending upon surrounding conditions. Many elements also have several values of covalence and electrovalence. Examples of some of the values of a few elements and radicals (groups of elements with an electrical charge) are listed in the accompanying table.

Uses of Oxidation Numbers

Not only do chemists need to have a number which will indicate the combining capacity of an element; it is also necessary to have a number which will indicate an equally important property of an element—its degree, or state, of *oxidation*.

The term oxidation was originally applied to the burning, or combustion, process (union with oxygen). Such processes can be illustrated by reactions of

EXAMPLES OF COVALENCE

ELEMENT CONSIDERED	COMPOUND	ELEMENT CONSIDERED	COMPOUND
Hydrogen (H)	1 in $\mathrm{H:\overset{..}{\underset{..}{O}}:H}$	Nitrogen (N)	3 in $\mathrm{H:\overset{..}{\underset{..}{N}}:H}$ $\mathrm{\cdot H}$
Oxygen (O)	2 in $\mathrm{H:\overset{..}{\underset{..}{O}}:H}$	Carbon (C)	4 in $\begin{array}{c}\mathrm{H}\\ \mathrm{H:\overset{..}{\underset{..}{C}}:H}\\ \mathrm{H}\end{array}$

EXAMPLES OF ELECTROVALENCE

ELEMENT	CHARGE	RADICAL	CHARGE
Sodium ion, Na^{+}	+1	Ammonium ion, NH_4^{+}	+1
Calcium ion, Ca^{++}	+2	Hydroxyl ion, OH^{-}	−1
Aluminum ion, Al^{+++}	+3	Nitrate ion, NO_3^{-}	−1
Copper ions, Cu^{+}, Cu^{++}	+1, +2	Carbonate ion, $CO_3^{=}$	−2
Iron ions, Fe^{++}, Fe_3^{+++}	+2, +3	Sulfate ion, $SO_4^{=}$	−2
Chlorine ion, Cl^{-}	−1	Phosphate ion, $PO_4^{\equiv}$	−3

These examples show how electrons give atoms and ions their two principal types of combining power, or valence. They show also how some atoms (copper, Cu, and iron, Fe) have more than one electrovalence.

oxygen with carbon, sulfur, or iron. In each case, the carbon, sulfur, or iron is said to be oxidized. In the reactions shown in the following example, the carbon, sulfur, and iron are oxidized to two different degrees, or states, shown one below the other.

$$2C + O_2 \rightarrow 2CO \qquad S + O_2 \rightarrow SO_2 \qquad 2Fe + O_2 \rightarrow 2FeO$$

$$C + O_2 \rightarrow CO_2 \qquad 2S + 3O_2 \rightarrow 2SO_3 \qquad 4Fe + 3O_2 \rightarrow 2Fe_2O_3$$

It is now well known that many elements can be oxidized in this way to different degrees, or states. It is also true that similar reactions can occur, not only with oxygen but with many other elements. For example, carbon, sulfur, copper, and iron will burn in chlorine gas. In such cases, these elements are said to be "oxidized," even though no oxygen is involved. The reactions with oxygen are used as a pattern or type for the others. Some products of "oxidation" with chlorine are:

$$CCl_4 \qquad SCl_2 \qquad CuCl_2 \qquad FeCl_3$$

The term used to describe the degree of oxidation of an element is *oxidation number*, or *oxidation state*. In electrovalent compounds the oxidation number of the element is the same as the electrovalence of each ion; but for covalent compounds the oxidation number is *not* the same as the covalence. For covalent compounds the oxidation number is defined as the charge the atom would have in the molecule if it were there as an ion. The distinction is important because, among other reasons, in many compounds atoms are formed into groups called *radicals*, such as manganese oxide (MnO_4^{-}). Within this radical, the bonds are covalent; but for the determination of the oxidation number, each atom must be considered as though it were present independently as an ion.

The rules for computing oxidation numbers of most elements are as follows

1 The oxidation number of an uncomb ned element is 0

2 The oxidation numbers of hydrogen and oxygen are 1 and 2 respectively

3 The sum of the oxidation numbers of all the atoms in a molecule is 0

There are a few exceptions to these rules where peroxides alkali metal hydrides and oxygen fluoride may be involved

Oxidation numbers provide a helpful method for classifying chemical react ons as follows

1 Reactions that involve no change in oxidat on number

Example $2HCl + Na_2CO_3 \rightarrow 2NaCl + H_2O + CO_2$

2 Reactions that involve change in oxidation number for certain elements

$$\text{Example } \overset{0}{Zn} + \overset{+1\,-1}{2HCl} \rightarrow \overset{+2\,-1}{ZnCl_2} + \overset{0}{H_2}$$

The oxidat on number for each kind of atom is written over the element symbols

Oxidation Reduction Reactions

React ons that involve a change in ox dation num ber are called oxidation reduction reactions An element is *oxidized* if the oxidation number has become *more pos tive in value For example in the equation* directly above the oxidation number of zinc has changed from 0 to +2 The term *reduction* describes the oppos te process when the oxidation number has *become more negative in value For example in the* equation directly above the hydrogen is reduced The oxidat on number has changed from +1 to 0 Not ce too that *if everything is counted through the entire* equation ox dation and reduct on are equal and balance to 0

Ox dation reduct on reactions are some of the most important *reactions known They are involved in* obtain ng metals from their ores (metallurgy) in combust on of fuels in ut lization of foods in the production of an electr c current in a battery and in all *electrolys s or electroplat ng processes*

Speeding Reactions by Catalysis

The rates of most reactions can be speeded up or retarded by the presence of a substance called a *catalyst Examples of catalysts are the coloring* material (chlorophyll) in plants vitamins in foods enzymes in digestive juices hormones in ductless glands and lead tetraethyl in ethyl gasoline

Why catalysts act as they do is not well known but it s known that a catalyst lowers the energy needed to make substances react We may say that it pro vides an eas er path for the react on somewhat like a tunnel *through a mountain*

Ions in Crystals Acids Bases and Salts

Atoms (and groups of atoms) with electr cal charges are called *ions* Studies with X rays have shown that *crystals of electrovalent compounds such as table* salt and Epsom salts are composed of ions in fixed posit ons rather than of atoms or of molecules existing as groups (*see* Ions Matter)

We commonly define an acid as a substance that yields hydrogen ions $(H)^+$ when in solution (*see* Acids Hydrogen) A *base* is a substan e that yields hydroxyl ions (OH) in any solution An acid neutral zes a base *to form a salt and water* For example

$$HCl + NaOH \longrightarrow NaCl + HOH$$

Some common examples of salts are these

$NaCl$ *(sodium chloride or common table salt)*

$MgSO_4$ (magnesium sulfate or Epsom salts)

Na_2CO_3 (sodium carbonate or washing soda)

$NaHCO_3$ (sodium acid carbonate or baking soda)

$CaCO_3$ (calc um carbonate or limestone)

$NaNO_3$ (sod um nitrate or nitrate of soda)

A compound that breaks down very largely into ions is called a *strong* electrolyte Those which ionize to a slight extent are called *weak* Acetic ac d (the acid of vinegar) and aqua ammonia are examples of weak electrolytes (*See also* Electrolysis)

Ions in Water Solutions

When crystalline compounds such as salts are dissolved in water the ions are separated from each other (*dissociated*) and they move about freely in the solu tion This reaction occurs because water has a marked *dissolving power* for crystall ne substances (*see* Solu *tions*)

This power can be explained most simply however by notic ng how water can d ssociate some *covalent* compounds—for example gaseous hydrogen chloride

The pure substance (HCl) exists at room tempera ture as a greenish yellow cloud of gaseous covalent molecules Chemists know however that these mol ecules are *polar* This means that the electrons are

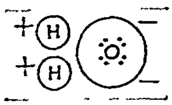
COMPARISON OF ELECTROVALENCE COVALENCE AND OXIDATION NUMBER

COMPOUND	ELECTROVALENCE	COVALENCE	OXIDATION NUMBER
$NaCl$	$Na^+ = +1$ $Cl^- = -1$	—— ——	$Na^+ = +1$ $Cl = -1$
H_2O	——	$H - 1$ $O = 2$	$H = +1$ $O = -2$
CH_4	——	$C - 4$ $H = 1$	$C = -4$ $H = +1$
CCl_4	——	$C = 4$ $Cl = 1$	$C = +4$ $Cl = -1$
CH_2Cl_2	——	$C - 4$ $Cl = 1$ $H = 1$	$C - 0$ $Cl = -1$ $H^+ = +1$
$KMnO_4$	$K^+ = +1$ $MnO_4^- = -1$	—— $Mn = 4$ $O - 1$	$K^+ = +1$ $Mn = +7$ $O = -7$

The first example (NaCl) shows that electrovalences and oxida tion numbers have the same va ues The next three examples show how covalences and oxidation numbers can differ only by absence or presence of charge In CH_2 and Cl_2 the strongly opposite electrovalent character of H and Cl accounts for all ox dat on phenomena and C has no charge

The compound $KMnO_4$ ionizes as the posit ve ion K^+ while the radical MnO_4^- is the negat ve ion The radical ion itself is held together by covalent bonds but if the atoms are con s dered as though they were ions the resulting oxidation numbers wou d be as shown

Hydrogen Chloride

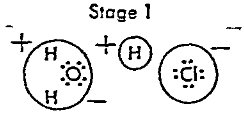


Water

not symmetrically arranged around the H and Cl atoms. They are attracted more strongly to the Cl. This weakens the bond between the H and the Cl and also gives the molecule a positive and a negative end. This kind of a molecule is called a *polar* molecule, and the bond is called a polar-covalent bond.

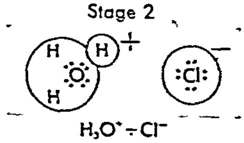
Water molecules likewise are polar. They have a distorted electron distribution and hence have positive and negative ends. This makes it possible for water molecules to attach themselves to ions or other molecules, and *hydrate* them (that is, combine them with water). This happens, for example, when HCl is added to water (Stage 1, right). The reaction occurs because they are both polar molecules.

Stage 1



Water (H_2O) and HCl

Stage 2



$H_3O^+ + Cl^-$

Another reaction also takes place, however. The oxygen atom has an unengaged pair of electrons that it can share. Furthermore, the proton H^+ in HCl is attracted more by the unengaged pair of electrons in the oxygen atom of the water molecule than it is by the pair on the chlorine atom. Therefore it leaves the chlorine atom and goes to the water molecule (Stage 2). This forms H_3O^+ and Cl^- ions.

The H_3O^+ ion is called a *hydrated hydrogen ion*, or *hydronium* ion (meaning H^+ combined with a molecule of water, thus: H^+H_2O). The bond between the H^+ and the H_2O is called a *co-ordinate-covalent* bond, because both electrons in the bond are supplied by one reactant (H_2O). Probably most hydrates of positively charged ions are formed by this kind of bond.

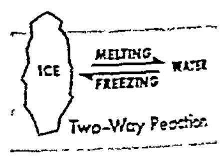
Hydration occurs with other ions, especially small ones such as Li^+, Be^{++}, and Al^{+++}. By exerting their polar character (or by using unshared pairs of electrons), water molecules can easily attach themselves to such ions by strong electrical forces. Since these forces become much stronger as the distances between the particles become shorter, the tiny H^+, a bare proton of small radius, forms hydrated ions readily.

Water molecules often remain attached to ions or molecules when a substance crystallizes. Such attached water is called *water of crystallization*, and the crystalline compound is called a *hydrate*. In formulas the water of hydration, or crystallization, is often indicated by a dot, thus (for sulfuric acid hydrate): $H_2SO_4 \cdot H_2O$.

Equilibriums in Two-Way Reactions

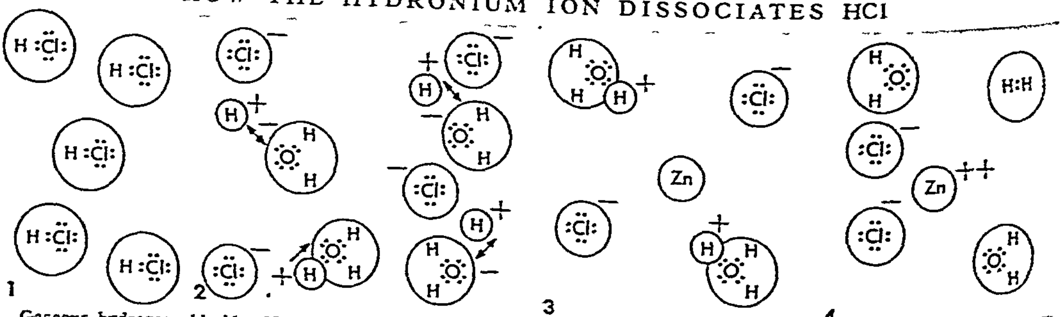
Many changes, or reactions, in nature and in chemistry are "two-way," or *reversible*. A good example of such a *physical* change is what occurs when ice is floating in water. Usually some melting takes place: that is, ice turns into water. However, some water near the ice will freeze. Which process will prevail depends upon the conditions that surround the "reacting system" of water and ice.

If the system is warm enough, melting will proceed much more rapidly than freezing until all the ice has become water. If the temperature is below the freezing point, however, the rate of freezing will surpass the rate of melting until all the water (down to a certain level) has become ice. At the exact melting point of ice or the freezing point of water, the two processes will be in balance, or in *equilibrium*. But the situation will be dynamic; that is, each process will be going on. The situation is not a static condition of nothing happening. The "two-way" reactions which go on constantly in such a situation are shown in the diagram directly above. (Usually the reactions which require *more* heat or other form of energy are considered to be "moving to the right" in such diagrams. For example, melting, which requires addition of heat to the reacting system, is shown as proceeding to the right.)



Two-Way Reaction

HOW THE HYDRONIUM ION DISSOCIATES HCl



Gaseous hydrogen chloride (HCl) exists as molecules held together by covalent bonds (1). When HCl is dissolved in water (H_2O), the molecules combine with water, then dissociate immediately into ions (2) which form positively charged hydronium $(H_3O)^+$ and negatively charged chlorine $(Cl)^-$. The chlorine atoms keep the electrons which formed the covalent bonds in the gaseous state of HCl.

An oxidation-reduction reaction occurs when atoms of zinc (Zn) are added to such a solution (3). The electrical forces involved promptly strip two electrons from the zinc atoms (oxidation number 0), leaving them as zinc ions. The hydrogen atoms gain the electrons and form gaseous hydrogen molecules (H_2) by covalent bonds. This leaves a solution (4) of dissociated zinc chloride ($Zn^{++}Cl_2^-$).

Another reversible physical reaction occurs between a liquid and its vapor Equilibrium is attained when the vapor is at saturation pressure in a closed container (*see* Matter)

Many chemical reactions are likewise reversible Among those which show important facts about equilibrium are the following

Ammonia manufacture	$N_2 + 3H_2 \rightleftharpoons 2NH_3$
Zinc copper ions	$Zn + Cu^{++} \rightleftharpoons Zn^{++} + Cu$
Carbonic acid	$H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$

If the conditions of these physical and chemical equilibriums are disturbed by such factors as changing the temperature, increasing the pressure or adding more solute, the reacting system will adjust itself It will dissolve more solute melt more ice or the like to minimize the effect of the change and establish a new equilibrium This adjustment to re-establ sh equilibrium is an example of what is known as the principle of Le Chatelier

How a Knowledge of Equilibriums Helps

There are many ways in which the knowledge of equilibriums is used by chemists Among them are the following

Example 1. Liquid $\rightleftharpoons$ Vapor Equilibrium If the amount of vapor (called the *vapor pressure*) that is in contact with its liquid state in a closed container is determined at several different temperatures a chemist can calculate the value of the heat of vaporization of the liquid This is the heat energy required to evaporate a gram molecular weight of the liquid

Example 2 $N_2 + 3H_2 \rightleftharpoons 2NH_3$ Equilibrium This is an important equilibrium in industry, since ammonia is an important industrial gas A knowledge of the effect of temperature and pressure as well as of catalysts on the reaction helps to determine the most efficient conditions for producing ammonia For example, high pressures will shift this equilibrium to the right (toward the formation of NH_3) This we can predict from the principle of Le Chatelier, because there are four volumes of reactants (one N_2 and three H_2) and only two volumes of product ($2NH_3$)

Example 3 $Zn + Cu^{++} \rightleftharpoons Zn^{++} + Cu$ Equilibrium This equilibrium depends upon the relative electron-attracting power of zinc atoms and copper ions, and is extremely important in electrochemistry Knowledge of it helps particularly in studies of electric cells and batteries Principles applying to this and similar reacting systems can be studied by measuring the electromotive force of a cell or battery made of zinc and copper All oxidation-reduction reactions involve this type of equilibrium

Example 4 $H_2CO_3 \rightleftharpoons H + HCO_3^-$ Equilibrium Weak acids and weak bases establish equilibriums of this type Such equilibriums are important not only in chemistry but also in biology and medicine These equilibriums can be shifted by changing the concentration of the ions For example if sodium acid carbonate ($NaHCO_3$) is added to a solution of carbonic acid the concentration of acid carbonate ion (HCO_3^-) is increased This yields more HCO_3^- ions to collide with H^+ ions to unite with them and thus to form more undissociated H_2CO_3 molecules Hence the concentration of H^+ ions is reduced and the acidity of the solution is thereby reduced (Degree of acidity / or alkalinity is often measured by ' hydrogen ion concentration " written pH as explained in the article Hydrogen) The effect produced upon an ionic equilibrium by adding a common ion is called the *common ion effect*

If a large excess of the salt $NaHCO_3$ is added, the H^+ concentration remains constant in spite of addition of more H^+ ions to the solution Such a solution made of a weak acid and an excess of a salt of a weak acid on a weak base is called a *buffer* system Buffer systems are important in many places one of them being the blood stream Buffers keep the H^+ ion concentration of the blood stream constant at a slight natural alkalinity of $pH = 7\ 4$ in spite of the varying charges on the different materials carried

The Fields of Chemistry

The work of the chemist in investigating different parts of nature and in synthesizing new things has made chemistry a very large field of study Consequently chemistry has been divided into a number of fields as follows

Analytical chemistry The methods of determining the identity (kind) and quantity of elements present in a substance is called analytical chemistry This field is divided into *qualitative* analysis or methods of identifying the *kinds* of elements present in a sample, and *quantitative* analysis which indicates the *amount* of the elements present

Today the chemist uses many methods in doing chemical analysis Some of the older methods are blow pipe analysis and analysis of samples by a complex scheme of separation and identification of ions by precipitation or by color Newer methods involve the use of the spectroscope the mass spectrograph, the X ray tube ultraviolet fluorescence and the atomic pile (*see* Radiation, Spectrum X-rays)

Organic chemistry We now know more than 600,000 compounds of carbon but only about 30 000 compounds of all the other elements The study of this large number of carbon compounds has been organized into a field known as organic chemistry Examples of organic compounds are gasoline, petroleum, sugar, starch cellulose proteins plastics, rubber, and fabrics (*See also* Organic Chemistry)

Inorganic chemistry The field of inorganic chemistry comprises the study of the compounds of all of the elements except those carbon compounds studied in organic chemistry

Physical chemistry The application of physical methods to the study of chemical problems is called physical chemistry Included in this field are atomic and molecular structure, theory of reaction rates, mechanism of reactions, chemical equilibriums energy changes in reactions, theories of solids, liquids, gases, and solutions electrochemistry and radioactivity This field is a fascinating study of border line problems between chemistry and physics

Colloid chemistry. This field comprises a study of the behavior of particles of matter that are larger than atoms and ordinary molecules but smaller than objects that can be seen with the best microscope. Particles in this range of subdivision (10 to 2,000 Å) have many properties unique to their size. Today this is a very important field of study. It includes such things as rubber, plastics, fabrics, viruses, chromosomes, and gases. Some of the tools used to study these particles are the ultracentrifuge, the ultramicroscope, and the electron microscope.

Biochemistry—Physiological chemistry. Both these fields involve the study of the chemical processes that occur in the living structure. They are of particular importance in agriculture, biology, bacteriology, and medicine.

Electrochemistry. This includes a study of the chemical reactions that produce an electric current and of the chemical reactions that are produced by an electric current. It embraces many other things such as the study of the electrical conductivity of solutions and of the phenomena that occur at electrodes. There are many applications of electrochemistry. Some of these are the metallurgical processes (aluminum, sodium, magnesium, and calcium are all obtained by electrolysis); methods of chemical analysis, the production of chemicals; and the determination of equilibrium processes.

Nuclear chemistry. This is one of the newest fields of chemistry. It includes a study of radioactivity, the structure of the nucleus, nuclear reactions, and the use of radioactive isotopes as tracers.

Chemical engineering. This is a border-line field between chemistry and engineering. It comprises the engineering processes, procedures, and problems involved in producing chemicals on a pilot plant or on a large-plant scale. It is one of our most important fields of engineering today.

Great Scientists Who Advanced Chemistry

Each of these four people made discoveries which opened great avenues of advance in chemistry. 1. Dalton established the atomic theory, the basis of 19th-century chemistry. 2. Mendeléev's work led to the Periodic Table and provided the basis for grouping elements in families and explaining their properties. 3. Marie Curie discovered radium, one of the keys to modern electrical theories concerning matter. 4. In our time Pauling has made great advances possible by establishing modern theories.

CHEMISTRY is one of the newest of the physical sciences. Its modern form and its powerful methods began developing about the time of the American Revolution, less than two centuries ago. All the preceding history of chemistry may be divided into three periods, which can be called (1) the period of "black magic"; (2) the period of alchemy; and (3) the period of transition, or "primitive modern," between alchemy and truly modern chemistry.

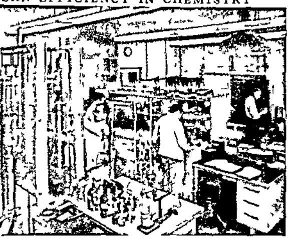
"Black Magic"—the First Period

The period of black magic extended from prehistoric times to about the beginning of the Christian Era. Throughout this long period in history mysticism and superstition prevailed. Most men believed that natural processes were controlled by spirits; and they relied upon magic to persuade the spirits to help while they conducted practical operations. During that time very little progress was made toward understanding how the universe is made. Men did, however, develop quite an array of practical knowledge. They recognized some elements, such as iron, gold, and copper; and they made some progress in such arts as glassmaking, metalworking, and alloying. This was the period of the Sumerian, Babylonian, Egyptian, and Greek cultures.

During this period, ancient Greek philosophers such as Thales and Aristotle speculated on the nature of matter, but their theories had little in common with modern chemical theories. They believed that earth, air, fire, and water (some of them imagined a fifth substance called the "quintessence") were the basic elements that composed all matter. They speculated also upon the possibility of abstracting such qualities as hardness, heat or cold, and color from common materials and combining them to make rarer or more valuable substances. They knew that iron could be made from a dirty, brown earthen rock and that bronze was made by combining copper and tin. Hence it seemed possible that if yellowness, hardness, and the like could be obtained and combined in cor-

EARLY GROPING AND MODERN EFFICIENCY IN CHEMISTRY

Modern chemistry grew out of ancient and medieval alchemy Alchemists worked for centuries with 'trial and error' methods to produce gold from less costly materials (left), and failed.



Today chemists bring to their problems a wealth of financial support splendid equipment and tested knowledge which has been accumulated through several centuries of research.

rect proportions, the product would be gold. Such speculations gave rise to alchemy

The Long, Sterile Period of Alchemy

The span of time from about the beginning of the Christian Era to about the 17th and 18th centuries is considered the period of alchemy The alchemists believed that they could convert metals into gold with the aid of a mystical thing called a philosopher's stone which they never found Many discoveries of new elements and compounds were made during this period, but the alchemists discovered very little that was worth while concerning the fundamental nature of matter or of the true nature of chemical reactions They were not able to do so because their basic theories were so far from describing what actually happens, as we understand these matters today (*See also* Alchemy)

In the 13th century such alchemists as Roger Bacon, Albertus Magnus, and Raymond Lully began to realize that the search for the philosopher s stone was useless They began to feel that alchemists might better search for ways and means to help the world s work with useful new products and new methods In the 16th century, another important leader in the new trend appeared in Theophrastus Bombastus von Hohenheim an aggressive talented Swiss Like many learned men of his day, he adopted a Latin name, using Paracelsus ("superior to Celsus' Celsus being a distinguished Roman physician of the 1st century A D)

Paracelsus insisted that the object of alchemy should be the cure of the sick rather than the fruitless search for gold The elements, he said were salt sulfur, and mercury (long connected with the "elixir"), and they would give health if present in the body in the proper proportions On this basis he practiced medicine and attracted many followers *This was the* period of *iatrochemistry*, or chemistry applied to the study of medicine

One of the first really scientific chemists was Robert Boyle In a book called 'The Skeptical Chymist' he rejected the elements of the iatrochemists and started the list of elements which we know today His name is also associated with the law concerning the volume and pressure of gases (*see* Gas) In 1661, he helped found a scientific society which later became the Royal Society of England.

Primitive Beginnings of Modern Chemistry

For about two centuries after Boyle, scientists continued to make useful discoveries They made little progress in fundamental theory, however, because they were still far from understanding the true nature of matter or from knowing what actually happens in chemical reactions

Perhaps the greatest source of confusion and defeat in these centuries was a theory of burning (combustion) called the *phlogiston* theory It was originated by the chemists Johann Becher and Georg Ernst Stahl According to this theory, heat was an "essence" called phlogiston, like yellowness and hardness in the theories of the ancient philosophers It was supposed to escape from substances during burning processes

By this time, chemists were learning to use the "modern method" of winning knowledge, that is, testing theories with experiments (*see* Science) But tests did not support the existence of phlogiston

The first clue to the truth came when an English chemist Joseph Priestley, discovered in 1774 that a certain gas (now called oxygen) was essential to the burning process (Oxygen was also discovered by a Swedish chemist named Scheele at about the same time) A few years earlier another English scientist, Henry Cavendish, discovered the element hydrogen A brilliant French chemist, Antoine Laurent Lavoisier, used the discoveries of Priestley and Cavendish to help him plan and perform a series of decisive experiments to solve the problem of the burning process He

gave us the present accepted theory of combustion (*see* Lavoisier). This contribution came at the time of the American Revolution, and it is often considered the beginning of modern chemistry.

The Atomic Theory and Modern Chemistry

Lavoisier's results gave chemists their first sound understanding concerning the nature of chemical reactions. Another cornerstone which dealt with the nature of matter came a few years later in the *atomic theory* advanced in 1805 by an English schoolteacher, John Dalton. This theory states that matter is made of small particles called atoms and that chemical changes take place between atoms or groups of atoms.

Being equipped at last with sound views about the nature of matter and of chemical reactions, chemistry began making rapid strides. In quick succession came Joseph Louis Proust's law of definite proportions and the gas laws of Joseph Louis Gay-Lussac. In this period too came the hypothesis of Amedeo Avogadro, an Italian chemist, about the number of molecules in a volume of gas. To Dalton's theory that the atoms of a single element have the same weight, Avogadro, in 1811, added the idea that one quart (or other volume of a gas) contains the same number of molecules as an equal volume of any other gas if both are at the same temperature and pressure. His calculations also showed that if the gas is an element (as hydrogen, oxygen, and so on), the atoms unite in pairs to form molecules (written H_2, O_2, and so on).

The scientists knew, however, that equal volumes of the different gases have unequal weights. Avogadro's hypothesis implied that this showed the relative weights of the single atoms. This has been proved to be correct, and today Avogadro's law may be stated thus: *Equal volumes of all gases under the same conditions of temperature and pressure contain the same number of molecules.*

Humphry Davy, about 1806, isolated a number of elements to add to the growing list (*see* Davy). Jōns Jakob Berzelius, in 1826, analyzed hundreds of compounds and published accurate tables of atomic weights. Friedrich Wöhler's synthesis of urea in 1828 proved that organic compounds could be made in the laboratory and opened a vast field of organic chemistry (*see* Organic Chemistry.) This began the development of the concept that organic compounds have geometrical structure. Friedrich Kekulé proposed the cyclic (ring) structure of benzene about this time. Michael Faraday formulated the laws of electrochemistry in 1834 (*see* Faraday).

Mendeléev's Basis for Modern Theory

By the middle of the 19th century, about 60 elements were known. John A. R. Newlands, Stanislao Cannizzaro, A. E. B. de Chancourtois, and others, had noticed that certain elements were much alike. The work of these men enabled Dmitri Mendeléev, in 1869, to publish the first Periodic Table. This table became the foundation of theoretical chemistry (*see* Periodic Table.)

To this period belongs the indefatigable Robert Bunsen, teacher and inventor of the spectroscope, the Bunsen burner, and many instruments (*see* Bunsen). The French chemist Louis Pasteur, one of the world's great geniuses, shed new light on the relation between chemical composition and molecular structure by his discovery of isomers (*see* Organic Chemistry). His work on antitoxins revolutionized biochemistry (*see* Pasteur).

Importance of Physical Chemistry

During the last quarter of the 19th century, physical chemistry became important through the work of Wilhelm Ostwald and Jacobus Van't Hoff on chemical equilibriums and Svante August Arrhenius on the theory of ionization. The mathematical formulation of the relations of equilibriums between the three states of matter (solid, liquid, and gas), called the "phase rule," was done by Willard Gibbs. Accurate atomic weight determinations were the work of Theodore Richards. Between 1894 and 1898, John Strutt Rayleigh and William Ramsay discovered helium and other inert gases.

After 1900 chemists began receiving invaluable aid from discoveries made in physics about the electrical nature of the atom. (*See* Atoms; Radioactivity; Radium.) Henry Moseley, working with X rays from the different elements, assigned atomic numbers to the elements. Max von Laue and Sir William Bragg and his son laid the basis for determining the structure of crystals by means of X rays. Francis W. Aston developed the mass spectrograph and used it to demonstrate the existence of isotopes. Later Harold C. Urey isolated an isotope of hydrogen which has become very important as a chemical tracer.

In 1896, Henri Bequerel and the Curies had discovered the phenomenon of radioactivity. This laid the basis for nuclear chemistry and physics (*see* Curie; Radioactivity; Radium). In 1919 Ernest Rutherford produced the first artificial transmutation of elements, and in 1934 the Joliot-Curies discovered that all elements could be made to be radioactive. By 1939 Otto Hahn, Fritz Strassmann, and Lise Meitner had established the occurrence on uranium fission. By the early 1940's nuclear reactions had been used to make radioactive isotopes of all elements from atomic number 1 to 98 inclusive. Glenn Seaborg contributed much to this latter work.

In the first 25 years of the 20th century, Rutherford's work laid the basis for the interpretation of the structure of atoms. Gilbert Lewis, Irving Langmuir, and Niels Bohr submitted the first qualitative concept of atomic structure in the period 1912–25. The more workable picture was given by the wave theory of matter (1925). In the late 1920's and early 1930's, Linus Pauling contributed much to knowledge of the nature of the chemical bond and of the relationship between structure of atoms and molecules and their properties.

From 1850 to 1950 scientists learned more about the fundamental nature of matter and of our universe than all mankind learned in the previous 50 centuries. This remarkable success demonstrates the power of the tool used by scientists—the *scientific method*

REFERENCE-OUTLINE FOR STUDY OF CHEMISTRY

I The meaning and function of chemistry how chemistry helps to understand our world C-209 how to take apart and recombine materials C-209-10 See also the Reference-Outline for Physics

II The structure of matter M 142a d

A Electrons and protons A 457-8 E-316 E-293-4 M 142e-g E-344c Einstein s theory of mass-energy relations R 100

B Atoms A-456 70 C-209 10

C *Molecules* C-210, G-28, H-317 A 456

D Physical states of matter C-209

1 Solids M 142b-c crystals and amorphous solids C-523

2 Liquids L-262-5

3 Gases and vapors M 142c G 28 30 L-265 transitions between liquids and vapors M 142

4 Colloids C-384

III Chemical behavior of matter

A Chemical symbols, formulas and equations *C-211 atomic structures C-212*

B Elements and their characteristics C 212 A-456

1 Atomic weights and numbers C 211 A 458

2 Periodic Table C-213 *P 150* table P 151

3 Families of elements C-212 table P 151 See also names of elements in Fact-Index

a. Metals C-213 M 176-7 table P 151 nonmetals and alkali metals A 168 alkaline earth metals A 168 alloys A 172-5

b Halogens C-213 C-298 table P-151

c Inert gases C-213 table P 151

d Radioactive elements R 154 R-56 U-405

4 Variations isotopes P 150

C *How metals form compounds C-210, O-424*

1 The meaning of valence C-215

2 Electrical character of valence C-215-16 A-460

D *Types of chemical reactions*

1 Uses of oxidation numbers C-216-17

2 Oxidation reduction reactions C-217 O-435

3 Reactions speeded by catalysis C-217

E Types of compounds

1 Acids alkalies (or bases) and salts C-217 A 9

a. Typical acids hydrochloric H-459 nitric *N 240* sulfuric *S-448 carbolic* C-119 hydrocyanic C-532 tartaric T 20

b Typical alkalies sodium hydroxide A 9 S-325 potassium hydroxide P 389

c Typical salts sodium chloride S-29 carbonate of lime C-178 *L-244* nitrates N-239 sulfates S-448 cyanides C-532

2 Radicals *A 168, A 236*

3 Silicones S-180

F Organic chemistry O-424-424d See also the Reference-Outline for Food

1 Hydrocarbons O-424-424a C-120 H 458 diagram O-424b

2 Carbohydrates (sugars starches and cellulose) O-424c *B-145 C-120 F 216-17 S-382 S-443*

3 Alcohols O-424b, A 145 C-216 glycerin G-127, esters O-424c

4 Organic acids O 424c diagram O-424b

5 Fats and oils O-424c, F-44 F 216 217 B-145

6 Nitrogen compounds amino acids proteins, enzymes C-424c, B-145, F 216 P-422, E-388

G How chemicals behave in solutions S-233 5

1 Dissociation and ionization I 205 M 142e-f E-301 E-315 C-217 how the hydronium ion dissociates hydrogen chloride diagrams C-218

2 Hydrolysis H-460 G 127

3 Electrolysis E-302 E-315 E-316

4 *Osmosis P 292 L-264* diagrams *P 293 L-265*

5 Solubility I 205

H Chemical equilibriums C-218 19

I Behavior of gases G 28

J Behavior of ions in crystals I 206 C-217, diagram S-234

IV The fields of chemistry C-219-20

A Analytical chemistry qualitative and quantitative C-219

B Organic chemistry O-424-424d B-145 7

C Inorganic chemistry C-219 20

D Colloid chemistry C-220 C-384-5

E Biochemistry and physiological chemistry C-220 *B-145-7 See also the Reference-Outlines for* Biology and Physiology

1 Plant chemistry B-146-7 P 290-5 L-151

2 Animal chemistry E-389 P-422 P 238

3 Bacteria and fermentation B-13 F-52 N 240

F Electrochemistry, nuclear chemistry, and chemical engineering C-220

V History of chemistry C-220

Note See also the Reference-Outline for Industry American

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CHERRY. Its delicious fruit and pretty pink and white blossoms make this one of the most favored of all trees. Americans eat more than 200,000 *tons* of cherries every year, baked in pies or served as sauces, desserts, preserves, brandies, and liqueurs.

Ornamental cherry trees which produce no edible fruit are planted only for their beautiful spring flowers. Cherry blossom festivals attract thousands of visitors. Best known in America is the one held in Washington, D. C., in April, when the Japanese cherry trees bordering the Tidal Basin burst into clouds of delicate pink and white blooms. The Japanese have long held such festivals, and the Koreans revere the tree almost as they would a god.

The cherry belongs to the rose family. The flowers look very much like those of the wild rose. Several wild species of cherry are native to America, but the fruit-bearing kinds were developed in Asia and had spread into Europe in prehistoric times. Pits of sweet cherries have been found in the caves of Stone Age man. The edible fruits belong to two species—the sweet and the sour cherries. A third type, the Duke cherry, is a hybrid of these two species.

Sour and Sweet Cherries

Sour cherries thrive in moderate, rather cool climates. The largest commercial orchards are in Michigan, New York, and Wisconsin. Among the many varieties are the Richmond, Montmorency, Morello, and Chase. Most of the crop is canned or frozen.

Sweet cherries require a mild climate, without frost, extreme heat, or summer rainfall at the time of ripening. They are grown chiefly on the Pacific coast. Popular varieties include the Black Tartarian, Bing, Lambert, Napoleon, and Royal Anne.

Genuine maraschino cherries are made from the marasca cherry, grown in Yugoslavia. To make the maraschino liquor, pulp is mixed with honey. The mixture is fermented, then distilled. Most of the maraschinos on the market are imitations made from Royal Anne cherries, grown chiefly in Washington and Oregon. The fruits are soaked in vats of sulfur dioxide for six weeks. Then they are pitted and sent to processing plants in New York and Chicago, where they are washed to remove the bleaching solution, cooked with sugar, and dyed with edible coloring matter.

Wild Cherries

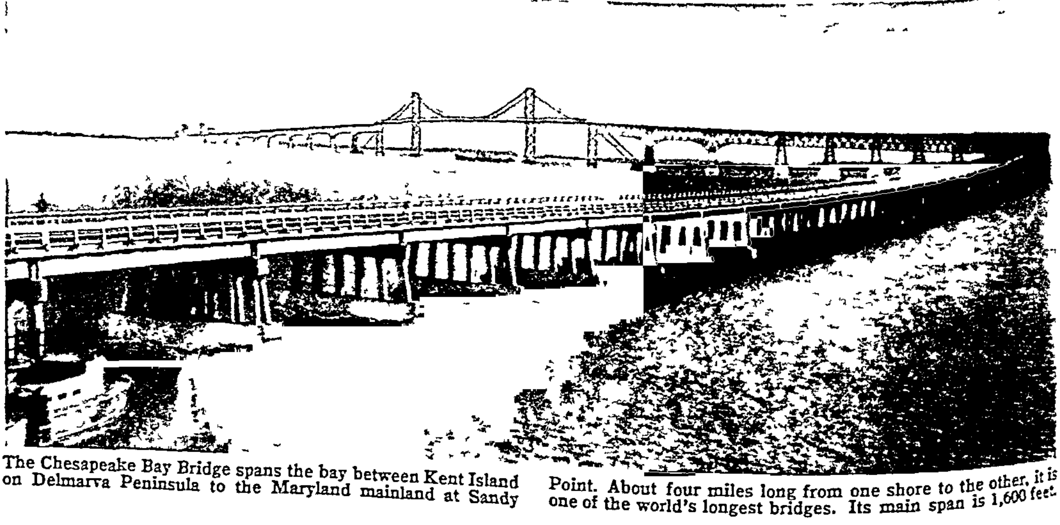
Wild black cherry trees are common in the eastern half of the United States and Canada. They grow along roadsides, fence rows, margins of thickets, and in open woods. Many birds consume the small dark fruit and help it to spread by dropping the stones where the birds perch. Black cherry is a medium-sized tree with rough, scaly black bark, smoother, reddish-brown branches, and long, narrow leaves with finely toothed edges. The heartwood is a rich reddish color with silky luster, prized for high-grade furniture and as a backing for electrotype plates used in printing.

Pin, or fire, cherry occurs with aspen trees on burned-over areas of Canada and the northeastern United States. Chokecherry is a shrub or small tree found throughout the United States and much of Canada. Sand cherry is a creeping shrub of beaches and dunes.

The cherry belongs to the genus *Prunus* of the rose family. The scientific name of the sweet cherry is *Prunus avium;* sour cherry, *P. cerasus;* wild black cherry, *P. serotina;* pin, or fire, cherry, *P. pennsylvanica;* chokecherry, *P. virginiana;* sand cherry, *P. pumila.* Ground cherry is a wild flower of the nightshade family, *Solanaceae.* (For pictures in color, *see* Fruits)

CHESAPEAKE BAY. The largest inlet on the Atlantic coast of the United States, Chesapeake Bay is notable for its history, ship activity, and sea-food production. Near its mouth at Jamestown, early colonists founded the first permanent English settlement in the Americas. Along its shores at Yorktown, the colonists later won the decisive battle for independence from the British. Near the head of the bay in another war, Francis Scott Key wrote the national anthem.

THE WORLD'S LONGEST OVER-WATER STEEL BRIDGE



The Chesapeake Bay Bridge spans the bay between Kent Island on Delmarva Peninsula to the Maryland mainland at Sandy Point. About four miles long from one shore to the other, it is one of the world's longest bridges. Its main span is 1,600 feet.

Along the bay are the major seaports of Baltimore and Hampton Roads and at Norfolk is the world's most important naval base This vast expanse of water is second only to New York harbor as the most active seaway in the eastern United States It is also one of the finest fishing grounds in the world

The bay is long and narrow Its upper section divides Maryland in two, its lower section cuts off a piece of Virginia (*see* Maryland, Virginia) Ships enter the bay from the Atlantic through its 13-mile-wide mouth between Cape Charles and Cape Henry

The bay is about 195 miles long, from 3 to 30 miles wide, and from 30 to 60 feet deep It is deep enough for coastal and ocean-going vessels It covers about 5,000 square miles of water If its deeply indented shore line were stretched out, it would reach about 27,000 miles

The Drowned Valley of the Susquehanna

Chesapeake Bay is a "drowned" river valley It is actually the lower part of the Susquehanna River This river drains into the bay at its head in the north and is navigable for only five miles A short distance upstream is Conowingo Dam, one of the largest hydroelectric developments in the nation

Along the western shore of the bay pour in broad and deep tidal rivers—the Patapsco, Severn, Patuxent, Potomac, Rappahannock, York, and James From the eastern shore the bay receives the Elk, Sassafras, Chester, Choptank, and Nanticoke rivers Many other lesser estuaries also empty into the bay.

A Historic Bay

From the earliest days of the United States Chesapeake Bay has figured in the nation's history In 1607 colonists from London landed on Cape Henry The fear of Indians caused them to sail up the James River and found Jamestown (*see* Jamestown) This was the first permanent English settlement in the New World Captain John Smith of the colony explored the bay in 1608 (*see* Smith) He gave it the Indian name *che-sep-ack*, ' country on a great river "

In Jamestown also the first session of a representative government in America was held It occurred in 1619 when the Virginia House of Burgesses met in a church That same year the first Negro slaves were brought to Jamestown from Africa Colonists from Virginia made the first permanent settlement in Maryland on Kent Island in 1631

During the Revolution, Lord Cornwallis surrendered to General Washington at Yorktown in 1781 (*see* Revolution, American, Washington, George, Yorktown) In the War of 1812 the British used Chesapeake Bay as an invasion route and burned the White House (*see* War of 1812, White House) While they bombarded Fort McHenry in Baltimore harbor in 1814, Francis Scott Key penned 'The Star-Spangled Banner' (*see* Key, National Songs)

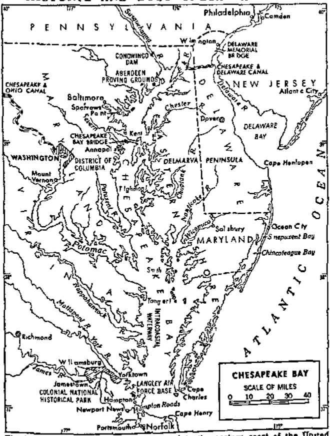
The historic duel of the ironclads, the *Monitor* and the *Merrimac* took place in Hampton Roads during the Civil War (*see* 'Monitor' and 'Merrimac') It marked the end of wooden naval ships

A Tour of the Bay

In a trip down the western shore of Chesapeake Bay from its head, one first sees the Aberdeen Proving Grounds Here the United States Army tests guns, tanks, and other heavy weapons

Next comes Baltimore, the sixth largest city in the United States (*see* Baltimore) In the time of sailing ships in the 19th century, its shipbuilders turned out the speedy Baltimore clipper Now its large harbor at the mouth of the Patapsco River handles great ocean vessels The city is a leading port and manufacturing center of the nation The sprawling Sparrows Point steel plant nearby uses Appalachian coal and imported iron ore.

HISTORIC AND BUSY CHESAPEAKE BAY



The long sliver of Chesapeake Bay cuts into the eastern coast of the United States. Its place names read like a history book—Jamestown, Fort McHenry, and others Its waters are busy with ocean ships and plentiful with fish.

Farther south, where the Severn River meets the bay, is Annapolis, the capital of Maryland and the site of the United States Naval Academy (*see* Annapolis; Naval Academy). Next are the wide Patuxent River and the even broader Potomac, which divides Maryland and Virginia (*see* Potomac River). On the banks of the Potomac are Mount Vernon, George Washington's home, and Washington, D. C., the nation's capital (*see* Mount Vernon; Washington, D. C.).

At Georgetown, Md., the old Chesapeake and Ohio Canal begins. Its promoters planned a 360-mile canal to connect Chesapeake Bay and the Ohio River, but they built only 185 miles of it, to Cumberland, Md. (1828–50). The 22-mile section to Seneca, Md., is in the national park system (*see* National Parks).

Down the Virginia shore is the Rappahannock River on whose banks much fighting occurred in the Civil War. The York and James rivers then create a long peninsula, one of the most historic areas in the nation. Here is Williamsburg, the colonial capital of Virginia, which has been restored (*see* Williamsburg). It, with Yorktown, Jamestown, the Colonial Parkway, and Cape Henry, forms the Colonial National Historic Park. Hampton, founded in 1610 near the tip of the peninsula, is the oldest existing English settlement in the United States. Nearby is Fort Monroe, built on the nation's oldest fortified site.

Huge Hampton Roads is where the James, Nansemond, and Elizabeth rivers flow into the southwestern part of Chesapeake Bay. This is one of the world's finest natural harbors, deep enough for the largest ships. Clustered about its 50 square miles of water are Newport News, Portsmouth, and Norfolk. These cities make up the port of Hampton Roads, one of the major port areas of the United States. It was an important supply port in both World Wars.

At Newport News is one of the world's largest shipyards. Norfolk is Virginia's second most populous city and one of the greatest naval bases in the world (*see* Norfolk). It is the operating base for the Atlantic Fleet. At Portsmouth is a big navy yard. Many naval and military establishments surround Hampton Roads, including Langley Air Force Base.

Delmarva Peninsula and Its Eastern Shore

The land between Chesapeake Bay on the west and the Delaware River, Delaware Bay, and the Atlantic on the east is the Delmarva Peninsula (*see* Delaware River). On it are almost all Delaware and the "Eastern Shore" consisting of parts of Maryland and Virginia (*see* Delaware). The turnip-shaped peninsula is named for the three states. It is 180 miles long and about 70 miles at its greatest width.

This low and fertile tidewater region furnishes truck crops, fruits, potatoes, poultry, and fish to the eastern seaboard. Salisbury, Md., is a center of the broiler industry; and Crisfield, Md., is called the "sea-food capital of the world." The peninsula has many shore resorts.

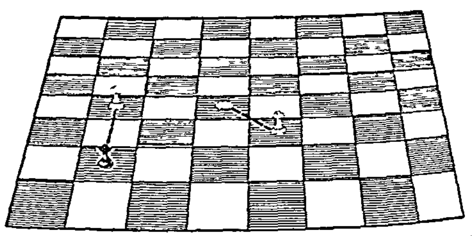
The Chesapeake and Delaware Canal cuts across the narrow 12-mile neck of the peninsula (*see* Canals). The canal links the Delaware River and the Elk River, an arm of Chesapeake Bay. This deep canal is part of the Intracoastal Waterway, a sheltered water route along the Atlantic and Gulf coasts. The waterway follows the bay and from Hampton Roads connects with Albemarle Sound through either the Dismal Swamp Canal or the Albemarle and Chesapeake Canal.

The fishermen and farmers of the isolated Eastern Shore and of the islands, such as Tangier Island, Va., and Smith Island, Md., preserve many old customs. The Eastern Shore is noted for waterfowl hunting and muskrat trapping. Chesapeake Bay Bridge, completed in 1952 between Sandy Point, Md., and Kent Island, Md., has made the Eastern Shore less remote.

Chesapeake Bay is one of the important commercial and sport fishing grounds of the United States for shell and fin fish. It is famous for oysters, crabs, and diamondback terrapin. Great quantities of the inedible menhaden are taken off the western shore of the bay to be made into fertilizer, soap, oil, and glue. In Hampton Roads are valuable oyster beds. Although subject to sudden squalls, the bay is one of America's best sailing and cruising waters.

CHESS. The game of chess is a warfare in miniature. If we accept one tradition, it was invented in India to divert men from the attractions of actual war. In chess two opposing forces—consisting on each side of the king and queen, two bishops, two knights, two rooks (or castles), and eight pawns (foot soldiers)—are drawn up in battle array. The strategy of the conflict lies in making a successful attack on the enemy's king. When one player or the other is unable to protect his king from capture on the next move he is "checkmated," and the game is over.

In the hands of masters chess becomes one of the most intricate and interesting games ever invented. Its value as mental training has often been urged. Some experts have developed such ability that they can play 10 to 14 games at the same time and with their eyes blindfolded.



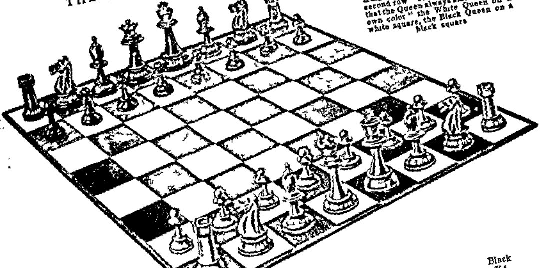
A pawn which has not left the second, or "pawn," row may move one or two squares ahead in its first move. After that it may only move one square. In capturing an opposing piece, however, the pawn moves forward one diagonal square

Chess is probably the most ancient of all games of pure skill. Its origin is lost in the legends and traditions of the past. It was undoubtedly invented somewhere in the Far East, passing from India to Persia (Iran), and thence to Europe. The word "chess" is supposed to be derived from "shah," the Persian word for king, and "checkmate" from "shah mat," meaning "the king is dead."

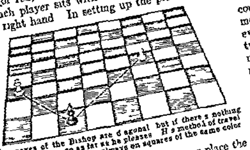
The chessboard is the same as the ordinary checker-

THE CHESS ARMIES DRAWN UP FOR BATTLE

Here's the arrangement of men as the game opens In the back row, from left to right, are Rook (or Castle), Knight, Bishop Queen King Bishop, Knight Rook The Pawns occupy the second row The one thing to note is that the Queen always stands on her own color " the White Queen on a white square, the Black Queen on a black square



board It is divided into 64 alternating black and white (or red) squares, and the board is so placed that each player sits with a white (or red) square at his right hand In setting up the pieces always



The moves of the Bishop are diagonal but if there's nothing in the way he can go as far as he pleases His method of travel as you can see, keeps him always on squares of the same color

'give the queen her color', that is, always place the white queen on the proper white (or red) square and the black queen on the proper black square

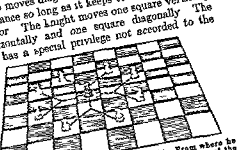
How the Pieces are Placed

The accompanying diagram shows the position of the pieces and pawns on the chessboard at the beginning of a game The pieces next to the king are called king's bishop (K B), king's knight (K Kt), and king's rook (K R) or castle while those next to the queen are designated as the queen's pieces for example, queen's bishop (Q B), etc In front of these pieces are arranged the pawns The notation 'P—K Kt. 4' indicates that the pawn (in this case the pawn in front of the king's knight column) moves to the fourth square in the king's knight column

The player using the white men moves first In the next game he uses the black his opponent the white A simple game called 'scholar's mate' is given here

White	Black
1. P—K4	1 P—K4
2 K B—B4	2. K B—B4
3 Q—R5	3 K Kt.—B3
4 Q takes B P (check and checkmate)	

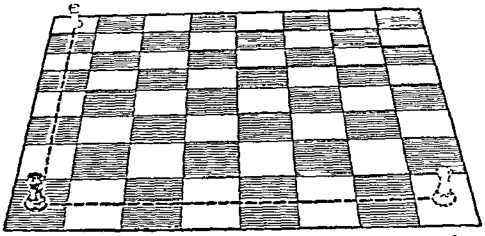
This game, though won by White by methods that could easily be defeated illustrates several of the moves of chess A pawn moves one square ahead, except on the first move when it may be advanced two squares Pawns cannot move backwards In making a capture, however, the pawn moves diagonally and occupies the square of the captured man A bishop moves diagonally in any direction and for any distance so long as it keeps to the square of its own color The knight moves one square vertically or horizontally and one square diagonally The knight has a special privilege not accorded to the



The most curious traveler of all is the Knight From where he stands in the middle of this board he can jump to any of the positions indicated by the dotted lines This is described as one square ahead and one diagonal '

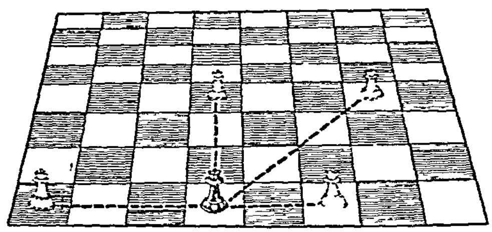
other pieces it can accomplish its move by jumping over any man happening to be in the way provided the move can be completed on a vacant square or on one occupied by an opposing man The knight then captures that man But the intervening piece is not

captured. Therein the chess "jump" differs from the "jump" in checkers. The rook or castle moves either vertically or horizontally any distance so long as the path is open. The queen is the most valuable of all



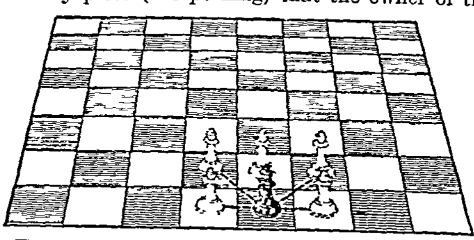
The Rook moves as far as he likes in straight lines; that is, lines parallel to the sides of the board.

the pieces; she can move vertically, horizontally, or diagonally, and for any distance. The king, on the other hand, is rather restricted; he can move in any direction, but to the extent of only one square. A capture is made by moving into a square occupied by an opposing piece, and all captured pieces are removed from the board.



The Queen is the most powerful piece of all, moving at will in any continuous direction, straight or diagonal, for any distance where the lines are clear.

Besides these there are certain special moves. A player may "castle" when his king row is open on either side between the king and the rook. The rook is moved up to the king and the king is "jumped" over to the other side of the rook. This cannot be done if either piece has previously been moved, if the king is in check, or if an opposing man could reach one of the intervening squares in a single move. A pawn reaching the king row of the opposing side becomes any piece (except king) that the owner of the



The King may move in any direction, but only one square at a time. He may not, however, move into a position threatened by an opposing piece.

pawn may choose. It is thus possible to have two or more pieces with queen's privileges at the same time.

To "check" the opposite player is to maneuver one piece or several pieces so that the enemy king is in danger of capture on the next move. When a king is thus threatened, the fact is customarily announced by the word "check," which notifies the opposing player that he must move his king or otherwise protect it. If a player is in check and cannot extricate his king, or capture the attacking man, or place some piece in front of the king as a protection, he is "checkmated." The king is never actually captured, and is never permitted himself to move into check. A "stalemate" occurs when one player or the other, though not in check, cannot move any of his pieces; more specifically, when one side cannot move without bringing his king into check. This is a draw. A game is also a draw when neither player has sufficient men left on the board to checkmate the other, as, for instance, when a king and one bishop are left against a king, or a king and one or two knights against a king. "Perpetual check" occurs when a player who cannot hope for checkmate is nevertheless able to check his opponent's king, move after move, with no possibility of escape, and this also constitutes a draw.

If a pawn which has not left the pawn row attempts to move two squares ahead, when such a move places it beside an opposing pawn, the opposing pawn may take the first pawn, just as if the latter had only moved one square ahead. This is called taking a pawn "in passing" or *en passant.*

A brilliant attack will sometimes win success before either side has lost many men, but in a hard fought match the game is usually won by an accumulation of a great number of small successes which weaken the enemy. A definite plan of attack is as a rule far better than a haphazard attempt to weaken the enemy by carrying off his pieces. A careful player always studies his opponent's moves as thoroughly as his own; not to do so is to invite disaster.

CHESTNUT. In the shade of majestic chestnut trees pioneer America worked and played. These beautiful trees lined the village streets of New England. From great chestnut forests came lumber for buildings, furniture, and fences. The wood was the chief source of tannin, used for curing hides. And the sweet-flavored nuts, roasted in the fireplace on cool autumn evenings, were a great delicacy.

A chestnut burr after frost bursts it open in the fall

Today the American chestnut has been almost wiped out by the chestnut blight, a disease caused by a fungus (*Endothia parasitica*). Few living mature trees remain in the blight-infested Eastern states. The disease was first observed in 1904. Apparently it was introduced from eastern Asia. Every attempt to check its spread has failed. It attacks the bark, killing a tree in one or several seasons.

THE CHESTNUT TREE AND ITS TREASURES

At right is shown the chestnut s columnlike trunk usually three or four feet in diameter The leaves shown at left are long and narrow with notched edges Clusters of golden catkins cover the tree in early summe fo lowed by pale green spiny burs which contain the two or three nuts

There are 11 species of chestnuts native to the temperate zone of the Northern Hemisphere The American species (*Castanea dentata*) ranges from Maine to southern Michigan and in the Appalachians south to Alabama Average trees tower 70 to 90 feet and have a shapely crown some 100 feet across American Japanese (*Castanea crenata*) and Chinese (*Castanea mollissima*) chestnuts have been crossed to develop a disease-resistant hybrid The European or Spanish (*Castanea sativa*) and the American chestnuts are now grown on the United States Pacific coast Other American species are the chinquap n which grows in the southeastern United States and the so-called horse chestnut which is a buckeye (*see* Chinquapin Buckeye)

CHEWING GUM If the sticks of gum Americans chew in a year s time were placed end to end they would circle the earth more than 35 times Americans chew more gum than all the rest of the earth s people together However during two world wars American soldiers introduced the treat to the people of many lands

The saps of cacti plants and many trees have been used for chewing since before the dawn of history Spruce gum was a favorite in the United States before General Santa Anna the Mexican dictator brought some chicle to New York City about 1860 during one of his periods of exile A New York inventor Thomas Adams found it an unsatisfactory substitute for rubber but he cooked some of it broke it into small pieces and placed it on sale in a neighboring store It sold quickly even though it had no flavor

A Louisville Ky drugg st John Colgan is credited with first flavoring chicle in 1880 He used an aromatic balsam S nce then gum has been given many flavors the most popular are peppermint spearmint and fruit flavor Some gum cut into pellets is candy-covered some is medicated Bubble gum is particularly popular with children This is made in a var ety of flavors but its interesting qualities are that it can be snapped loudly and because it contains a small amount of rubber latex blown into bubbles

Today chew ng gum is made of sugar and glucose (about 70 per cent) a gum base (28 per cent) caramel paste and flavoring extracts The chief base is *chicle* (synthetic bases are also used) Chicle (pronounced *chĭk' l* or *chĭk le*) is the boiled-down latex or sap of the sapodilla a tropical evergreen mostly found in the rain forests of the Yucatán peninsula British Honduras and Guatemala This base is supplemented with various latexes found in South America Malaya and the Indonesian islands The principal supplement is *jelutong* (also called *pontianak*) which is taken from a kind of rubber tree

Latex is obtained by gashing the trunks of trees and catching the oozing latex in canvas bags A tree can be tapped once every four to e ght years The latex is boiled until the water content is reduced to about 35 per cent It is then hardened and kneaded into blocks of about 25 pounds Central American chicle collectors and boilers are called *chickleros* there are about 20 000 of them (For a p cture of a chicle block *see* Central America)

Most of the bases are shipped to the United States There in air-conditioned factories they are cleaned filtered and mixed with other ingredients in revolving ovens which are kept at a temperature of about 250° F The mixture has a doughlike appearance when it comes from the oven Roll ng machines flatten the dough into slabs the thickness of gum Next the mixture is given a conditioning treatment so that the gum will retain its flavor Finally the slabs are scored to stick sizes which are separated individually wrapped and placed in packs of five All these processes are done with machinery

Chewing gum brings about muscular relaxation probably because the chewing is imitative of eat ng Some dentists warn against excessive chewing of gum they claim that the constant bathing of teeth in the sugar and syrup contained in the gum increases tooth decay

CHEYENNE Wyo Through a turbulent early history of sharpers gamblers railroad construction vigilantes and cattle and sheep wars Cheyenne has grown into Wyoming s capital and largest city It lies on a 6 000-foot plain in southeastern Wyoming The plain s westward upslope rises into the nearby Laramie Mountains.

WYOMING'S CAPITAL CITY

This Fairchild Aerial Survey view of Cheyenne shows the great airport (top), and the business section (foreground). At the upper left is the State Capitol.

In 1867 Gen. Grenville M. Dodge, the Union Pacific's chief engineer, selected the site as a division point on the nation's first transcontinental railroad. He named it after an Algonquian Indian tribe, whose pronunciation was *shī-ăn'na*. The early settlers soon shortened this to *shī-ĕn'*, the present pronunciation.

Before Fort D. A. Russell was completed (to protect construction workers from Indian attacks), rumor of land selection brought in speculators, gamblers, saloonkeepers, storekeepers, and freighters. They built a frontier town of flimsy shacks, tents, and sod houses. The rail line from Council Bluffs, Iowa, had then been completed to Julesburg, Colo., a hundred miles to the southeast. The rails reached Cheyenne in November 1867 and drove on westward. The vigilantes' harsh laws brought some order, but the sharp explosion of "six-shooters" continued as the frontier seethed under the differences of rail workers, gold seekers, cattlemen, and sheepmen.

The prosperity of today's Cheyenne rests on state and federal offices, great rail workshops, an immense airplane test and repair depot, an oil refinery, a meat-packing plant, and a large wholesale and retail trade. Fort Russell, in 1930 renamed Francis E. Warren after a former Wyoming governor and United States senator, adjoins the city on the northwest. Many acres along the shores of the five lakes that lie within or border the city have been made into parks. Other points of interest include the State Capitol, designed in 1887; the Supreme Court Building, built in 1937, which houses the court, a large law library, the state historical museum and library, and several state departments; and the red-brick Governor's Mansion erected in 1905. Cheyenne Frontier Days, an annual five-day fete that features a rodeo, is attended by thousands of visitors.

Shortly after Wyoming was made a territory in 1868, Cheyenne was made its capital; it remained the capital when the state entered the Union in 1890. The city has the commission form of government. (*See also* Wyoming.) Population (1950 census), 31,935.

CHIANG KAI-SHEK (*gē-äng' kī' shĕk'*) (born 1887). A united vigorous China, free of foreign domination —that was the lifelong dream of Gen. Chiang Kai-shek. As president and premier of the Chinese Republic and commander of its army, General Chiang strove to make that dream a reality. In his efforts he became one of the most controversial men of his time.

Chiang was the son of a middle-class wine merchant of the village of Chikow in Chekiang province. When he was 15 years old, his mother, following the Chinese custom of that time, arranged his marriage to a girl whom young Chiang saw for the first time on his wedding day. Already determined on a military career, the young husband went to Tokyo in 1907 to study at the Military Staff College. There he became a disciple of the exiled Chinese revolutionary, Dr. Sun Yat-sen, "Father of the Chinese Republic." In 1911 Chiang returned to China and took part in the revolt which established the Chinese republic.

Exiled to Japan

When the republic fell into the hands of reactionaries, the young officer joined in an unsuccessful revolt in 1913, which cost him his army post; and another in 1916, which forced him into temporary exile in Japan. In 1923 Dr. Sun sent him to Moscow to study Soviet military and political institutions. On his return Chiang founded a military academy at Canton, the southern stronghold of the revolutionaries. After Dr. Sun's death in 1925, Chiang, supported by his well-trained cadets, rose to power in the Kuomintang (Nationalist party) and in 1926 took command of the Nationalist army.

General Chiang then began his conquering advance to the north of China, with Peking, capital of the weak republic, as his goal. In an epic 1,200-mile march he gained control of south and central China. In 1927 he established his capital at Nanking. Alarmed by the growth of Communism, Chiang dismissed his Soviet advisers and ruthlessly crushed the Chinese Communists. When Kuomintang officials denounced him, Chiang, in a characteristic gesture, resigned all his offices and went to Japan for a brief visit.

Marriage to Soong Mei-ling

Having divorced his childhood wife some years previously, Chiang proposed marriage to Soong Mei-ling, of the famous Soong family. The head of the family, Charles Jones Soong, was an American-educated Chinese who became a Christian missionary and made a fortune by publishing Bibles. From his marriage to a Chinese Christian woman came three sons and three daughters, all of whom were educated in the United States. One of the sons, T. V. Soong,

CHINA S NATIONALIST LEADERS

Here are Gen Chiang Kai-shek and his wife Me ling when he was strong man of Ch na H s government fell to Chinese Communists in 1949

became China s leading financier The eldest da ghter Soong Ai ling married Dr H H Kung banker and *minister of finance The second daughter Soong* Ching ling became the wife of Dr Sun Yat-sen

Mei ling a graduate of Wellesley College was re nowned for her beauty and her brilliant mind To marry her Chiang Kai shek promised her m ther that he would study the Christ an relig on Mei l ng and Chiang were married in 1927 It was due largely to her that Chiang became a Methodist in 1930 As her husband s secretary and most trusted adv ser Ma dame Chiang became one of the world s famed women

Trying to Build a United China

Soon after his marriage Chiang resumed *command* of the Kuomintang army and cont nued his drive to the north In 1928 his army entered Peking (Pe ping) and as chief of the Kuomintang party Ch ang be came the head of the Republ c of China

China however was st ll far from unified For years Chiang battled insurgent regional commanders and armed Communist forces When Japan invaded Man chur a in 1931 Chiang offered no res stance as he believed China still too weak to r sk a war Wide-spread cr ticism of his policy forced him to res gn *as head of the nation but he continued as commander* of the army In 1933 he ma le peace with Japan

Chiang was playing for t me He speeded his pro-gram for unifying and strengthening Ch na He got a measure of accord from the Communists and with the aid of fore gn advisers worked to n odernize his army and air force In 1935 he became premier and w th Ma lame Chiang launche l the New Life move-ment—a program designed to improve the lot of the masses through education home industries and self help The Ch angs hoped that bit by bit the program would ease the vast poverty and to l of the peasants

Japanese Invasion and Second World War

When Japan aga n invaded China in an undeclared war July 27 1937 the nation rallied to Chiang as its *generalissimo* He saved most of Ch na from the invaders and accompl shed the gigantic task of mov ing industr es and schools to the *interior* In 1942 in the second World War he became Allied command er in Ch na (*see* World War Second) He was elected Ch na s pres dent in 1943 and re-elected in 1948

China received economic a d from the Un ted States b it Chiang fa led to push economic and politi cal reforms Corruption ri ldled his Nat onalist gov ernment funds were misused and fantast c inflat on brought increasing hardship to the masses Nationalist China was tottering Critics of Chiang blamed the crisis on his fa lure to clean up pol tical and econom c *pract ces His supporters countered that the over* whelming problems and the armed aggress on of Chi nese Con munists were too much for one man without strong nternational support

Flees to Formosa Gets American Aid

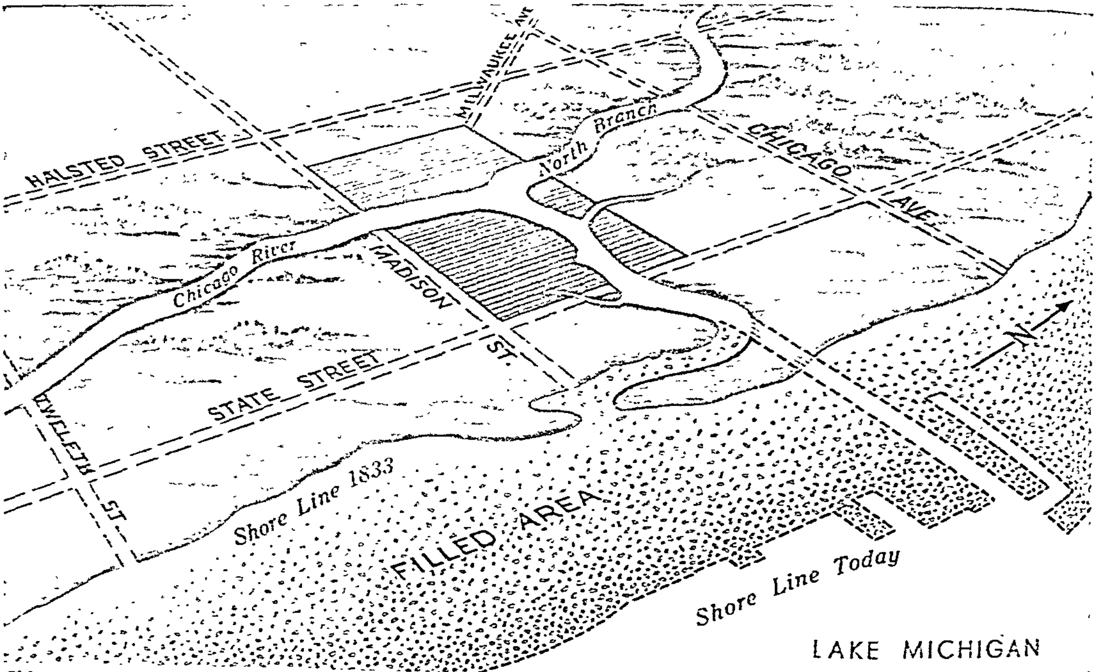
Cl iang had renewed the war against the Chinese Communists in 1945 and was steadily dr ven back When the Communists won control of China in 1949 Chiang escaped to Formosa where he set up a refugee government Madam Ch ang went several t mes to the Unite l States to plead for more Amer can ai l

American m litary a lv sers helped train Chiang s army on Formosa wh le guerrilla bands fought on the ma nland In 1954 Chiang was re-elected president and some 13 000 veterans of tl e Korean ar—who h id refu e l to return to Red Cl na—joined his army

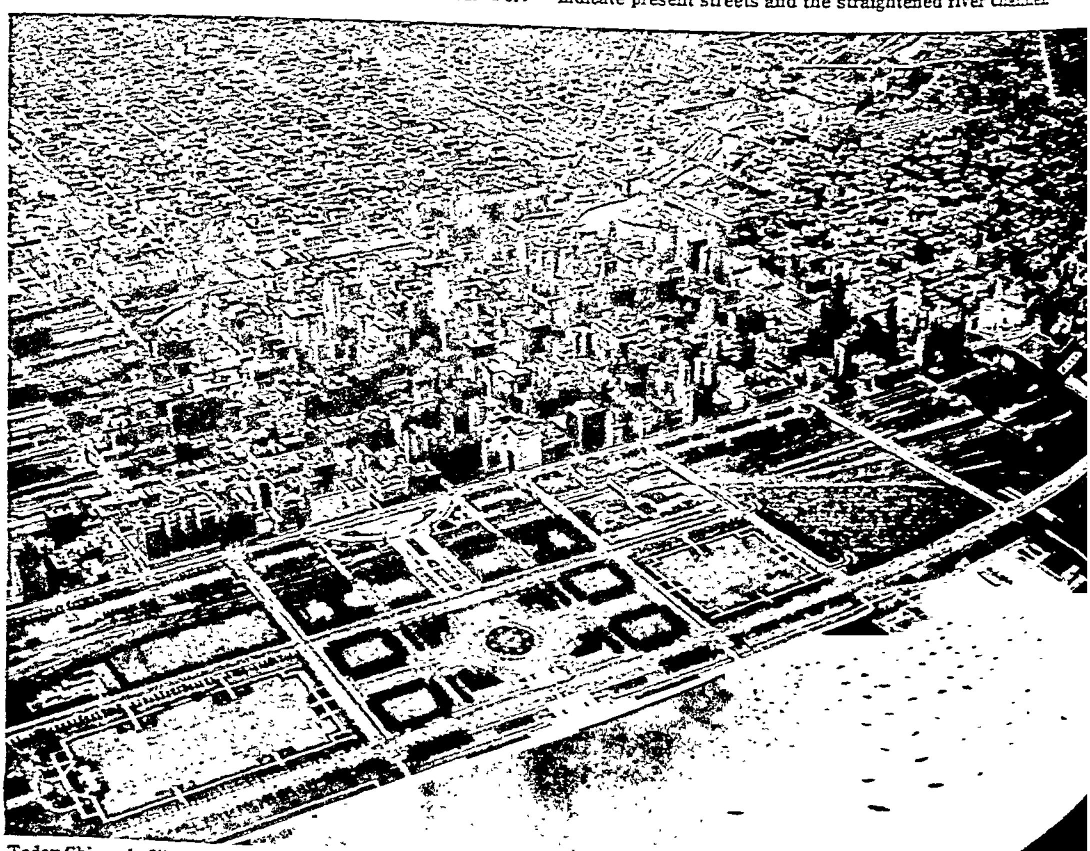
REBUILDING ARMY IN EXILE

Chiang Ka shek w th cane inspects a mortar emplacement at a Nationalist mil tary academy on Formosa The aging general aided by American advisers also refitted his few naval units

THE GROWTH OF A GREAT CITY



Chicago was carved out of swampland and organized as a village in 1833. Its limits are shown by the dark area. Fort Dearborn stood just to the east of the village. Broken lines indicate present streets and the straightened river channel



Today Chicago's filled-in shore line is Grant Park, the beautiful "front yard" of the city's downtown area. The towering mass of buildings south of the Chicago River is the Loop area, the business center of America's second largest city.

The GIANT CROSSROADS *of* MID-AMERICA

CHICAGO One of the first white men to visit the site of Chicago was the famous French explorer René Robert Cavelier, Sieur de La Salle La Salle s keen eyes saw more than a sluggish river idling through swampland to enter Lake Michigan This he said, "will be the gate of empire this the seat of commerce"

The story of the development of the city is as amazing as the accuracy of La Salle s prophecy In 1830 Chicago consisted of a cluster of log cabins huddled close to Fort Dearborn Sixty years later the city had passed the million mark in population Today it is the second largest city in the Western Hemisphere and the sixth largest in the world

The once-dreary swamp now contains more miles of streets than some states have roads it has more telephones than Russia It handles more freight and it spends more money for governmental purposes than some member countries of the United Nations Three fourths of the states have less people than Chicago and one third of the states have fewer radio stations In six blocks on Chicago s State Street more retail clothing dry goods and department store business is transacted than in any similar area in the world Chicago is second only to Washington D C in space occupied by federal government agencies

Chicago leads other cities in many fields It is the world s greatest railway center the terminus of 19 trunk lines whose combined mileage is half the entire railroad mileage in the United States It is the world s greatest livestock market and meat-packing center, producing about one sixth of the nation s meat output It is the world s largest grain market, and the prices paid for wheat on the Chicago Board of Trade help fix the price of the nation s bread

Chicago is one of the nation s great ports handling tremendous cargoes of iron ore coal and limestone for steelmaking It is the foremost mail-order distributing center The Chicago metropolitan area makes more machinery and communication equipment and builds more railway equipment than any other place on the globe Its agricultural implement industry supplies farmers all over the world

The Ground Plan of the City

The visitor who approaches Chicago from Lake Michigan sees a great metropolis curving along the shore for more than 29 miles To the north stretch the pleasant north shore suburbs and Fort Sheridan and the Great Lakes Naval Training Station To the south lie the busy manufacturing cities of northwestern Indiana—Hammond, East Chicago Whiting Gary—belching smoke by day and flame by night

At the heart of the city is the Chicago River The North and South branches of the river form a gigantic "Y" with its base on the lake Near here is a dense cluster of the city's largest buildings gathered on or near a rectangle seven blocks long and five blocks wide This is Chicago s famous *Loop girdled* by a belt of elevated railways Within this crowded

Population (1950 census) 3 620 962 Cook County, 4 508 792 metropolitan area 5 495 364 Growth of city *1837* 4 170 *1850* 29 963 *1880* 503 185 *1900* 1 698 575 *1940* 3 396 808
Area Land 212 9 sq mi inland water 4 6 sq mi
Location 41° 50 N lat 87° 37 W long
Altitude Highest 665 ft lowest 581 ft
Transportation *Railroads* 19 trunk and 17 belt and terminal *water* Great Lakes system and Illinois Waterway *air* 15 airlines *highways* 8 national 13 state
Climate *Average temperatures*—annual 50° highest monthly 75° (July) lowest monthly 25° (January) *Average precipitation*—annual 33 inches

district a quarter of a million people work and another million come every day to shop transact business and "see the sights"

The stone and steel of this tower ridged sky line is softened by tree lined drives and parks along the lake front Lincoln Park to the north and Jackson Park to the south are great wooded expanses while Grant and Burnham parks form a geometric green rug for the city's 'front yard'

Radiating from the Loop are Chicago s three huge sprawling sections—North Side South Side and West Side (to the east lies Lake Michigan) Each section is a subcity of about a million people containing its own residential areas, shopping districts, industrial plants, and recreation grounds

Crossroads of America

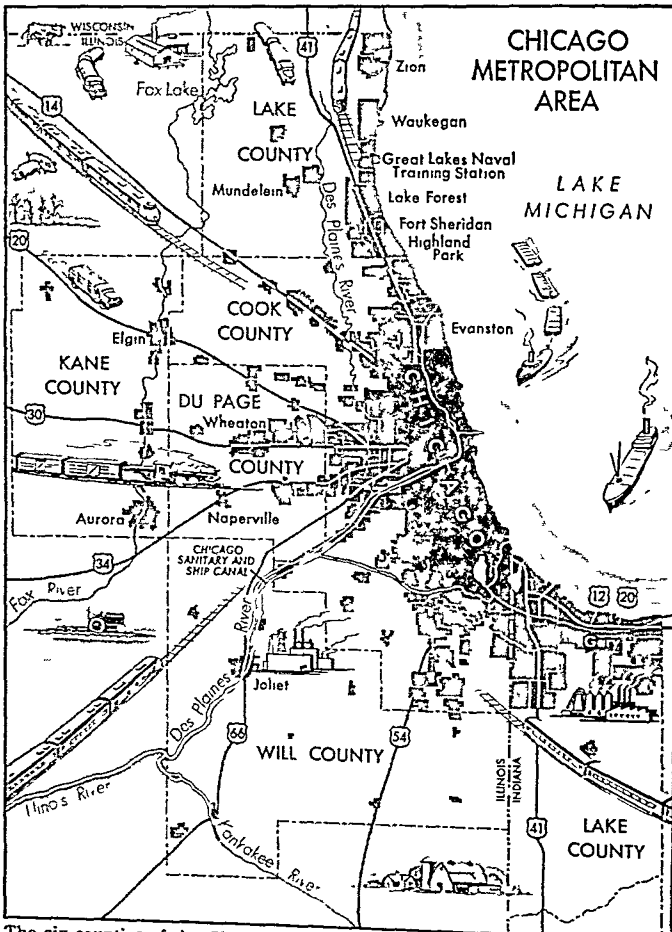
Located near the center of North America Chicago is a gigantic center of transportation by water, rail, road and air Five harbors at the foot of Lake Michigan make the Chicago area the second largest port on the Great Lakes From here foreign and domestic steamship lines carry on trade with Europe by way of the Great Lakes-St Lawrence River water route to the Atlantic To the south and west is the Illinois Waterway connecting Chicago with the Mississippi River and the Gulf of Mexico

Chicago also lies astride the natural land routes between East and West Here Lake Michigan thrusts far down into the *Middle West forcing highways as* well as rail lines to converge at this point As a result the city has become the nation's greatest terminus for bus truck, and rail transportation

Chicago's location has also made it a vital aviation center *Chicago Midway Airport is* one of the busiest in the world Airplane arrivals and departures from here average one every two minutes day and night *The city also owns huge O Hare Field north-*west of the city and Meigs Field for small aircraft at the lake front

A Giant of Industry

In addition to being a transportation center Chicago is also the industrial capital of middle America Much of the city's manufacturing is based on the abundant natural resources that lie within easy transporting distance of the city These resources include rich deposits of iron ore and coal, numerous



The six counties of the Chicago metropolitan area are classified by the Census Bureau as a single unit for business, industrial, social, and population purposes.

oil wells, heavy stands of timber, and a fertile soil for raising food crops and livestock.

From the 12,000 industrial establishments in the Chicago metropolitan area comes an enormous supply of manufactured goods. During an average year the total value added by manufacturing in this area amounts to $5\frac{1}{2}$ billion dollars. Food products alone claim 714 million of this total; printing and publishing, 498 million; fabricated metal products, 495 million; machinery, 460 million; iron and steel, 423 million; communication equipment, 416 million; and chemicals, 385 million.

The People of Chicago

In 1830 the frontier community of Chicago had 50 residents. During the next one hundred years it grew into a city of more than 3,300,000. Since that time the population has continued to increase, but the rate of growth has been slower than that of its neighboring suburbs. From 1940 to 1950 the city population increased only 7 per cent; during the same period the suburban population increased 17 per cent.

During the 1840's and 1850's the first large groups of immigrants settled in Chicago. They were the Irish and Germans. Later more than 30 other national and racial groups entered Chicago. Many of these people set up their own "cities within the city." By 1930 the number of foreign-born residents reached a high of 855,777. Since that time, however, their number has steadily declined and the distinctive communities have largely disappeared. Today the largest foreign-born group are the Poles, followed by the Germans, Italians, Russians, Scandinavians, Irish, and Czechs.

The decrease in the number of foreign born was accompanied by a steady increase in the Negro population. At the end of the first World War there were about 100,000 Negroes in the city, by 1950 this number had risen to about a half million, most of them concentrated on the city's South Side.

Six counties are considered part of the Chicago metropolitan area—Cook, Du Page, Kane, Lake, and Will counties in Illinois and Lake County in adjoining Indiana. This area covers 3,482 square miles and contains an average of more than 1,500 persons per square mile.

Chicago Turns Its River Around

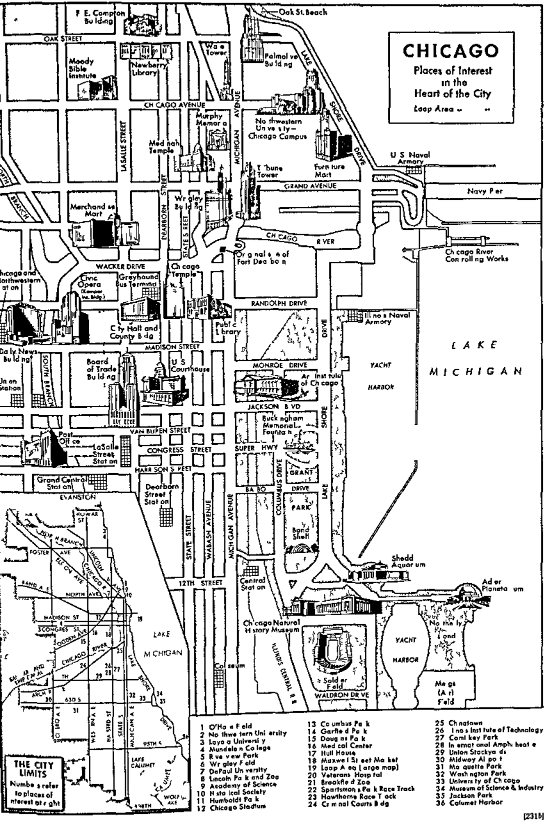
Chicago has had to meet many problems brought about by its rapid growth. One of the chief problems for many years was sewage disposal. At first Chicago emptied its sewage into the lake and drank contaminated water. The result was a high typhoid-fever rate.

After several corrective measures had failed, Chicago finally found a solution in 1890. West of the city flowed the Des Plaines River, which emptied into the Illinois and thence into the Mississippi. The bed of the Des Plaines was slightly lower than that of the Chicago River. A canal was built joining the two and promptly the Chicago River reversed itself and began to flow *out* of the lake instead of *into* it. The reversed river carried the sewage out of the city and reduced the typhoid rate to almost zero.

This system worked effectively from 1900 to 1930. Then the federal government ordered that the water diverted from Lake Michigan be reduced from 10,000 to 1,500 cubic feet a second by 1939. This decision forced the city to build treatment plants for sewage disposal. The new plants began functioning in 1939. Meanwhile, the Sanitary and Ship Canal, as it is called, became a vital link in the Illinois Waterway, completed to the Mississippi in 1933.

Other Problems of Growth

Traffic control has been another major problem. To relieve acute congestion in the Loop, 62 miles of freight tunnels were built 40 feet below the streets. Through them 150 electric locomotives haul goods to commercial houses and remove waste materials



CHICAGO
Places of Interest in the Heart of the City
Loop Area
F. E. Compton Bu ld ng
Oak St. Beach
OAK STREET
Moody Bible Institute
Newberry Library
Wa e Tower
Palmol ve Bu ld ng
LAKE SHORE DRIVE
CH CAGO AVENUE
Murphy Memor a
No thwestern Un ve s ty–Chicago Campus
Med nah Temple
LASALLE STREET
MICHIGAN AVENUE
T bune Tower
Furn ture Mart
U S Naval Armory
GRAND AVENUE
Navy P er
Merchand se Mart
DEARBORN STREET
STATE STREET
Wr gley Bu ld ng
CH CAGO R VER
Or g nal s e of Fort Dea bo n
Ch cago River Con roll ng Works
BRANCH
WACKER DRIVE
Ch cago Temple
Chicago and Northwestern at on
Civic Opera (Kemper Ins. Bldg.)
Greyhound Bus Termina
RANDOLPH DRIVE
Ill no s Naval Armory
C ty Hall and County B dg
Publ c L brary
DRIVE
LAKE
MICHIGAN
MADISON STREET
Da ly News Bu ld ng
SOUTH BRANCH
Board of Trade Bu ld ng
U S Courthouse
MONROE DRIVE
YACHT HARBOR
Ar Inst tute of Ch cago
Un on Station
JACKSON B VD
Buck ngham Memorial Founta n
SHORE
VAN BUREN STREET
Post Off ce
LaSalle Street Stat on
CONGRESS STREET
SUPER HWY
COLUMBUS DRIVE
GRANT
HARR SON S REET
Grand Central Stat on
Dearborn Street Stat on
BA BO DRIVE
PARK
Band Shell
STATE STREET
WABASH AVENUE
MICH GAN AVENUE
LAKE
Shedd Aquar um
12TH STREET
Central Stat on
Ad er Planeta um
Ch cago Natural H story Museum
ILLINOIS CENTRAL R R
No the ly sland
YACHT HARBOR
Col seum
Sold er F eld
WALDRON DR VE
Me gs (A r) F eld
EVANSTON
HOWAR ST
NOR H BRANCH
FOSTER AVE
LINCOLN
ELS ON AVE
CHICAGO R
NORTH AVE
MADISON ST
CONGRES ST
OGDEN AVE
RIVER
CHICAGO
LAKE
M CHIGAN
LAKE SHORE DRIVE
ARCH R
63D S
95TH S
LAKE CALUMET
CALUMET
WOLF LAKE
138TH
WES RN A E
HA STED ST
STATE S
MICH CAN A E
THE CITY LIMITS
Numbe s refer to places of nterest at r ght
1 O'Ha e F eld
2 No thwe tern Uni ersity
3 Loyo a Universi y
4 Mundele n Co lege
5 R ve v ew Park
6 Wr gley F eld
7 DePaul Un versity
8 Lincoln Pa k and Zoo
9 Academy of Science
10 H sto ical Society
11 Humboldt Pa k
12 Chicago Stadium
13 Co umbus Pa k
14 Garfle d Pa k
15 Doug as Pa k
16 Med cal Center
17 Hull House
18 Maxwel St eet Ma ket
19 Loop A ea (arge map)
20 Veterans Hosp tal
21 Brookfie d Zoo
22 Sportsmen s Pa k Race Track
23 Hawthorne Race T ack
24 Cr m nal Courts B dg
25 Ch natown
26 I no s Inst tute of Technology
27 Coml key Park
28 In ernat onal Amph heat e
29 Union Stockya ds
30 Midway Ai po t
31 Ma quette Park
32 Wash ngton Park
33 Univers ty of Ch cago
34 Museum of Science & Industry
35 Jackson Park
36 Calumet Harbor

[2315]

Surface traffic continued to increase so tremendously that in 1938 the city began construction of passenger subways to link up with elevated railroads in outlying districts. Automobile and truck traffic was speeded by widening main arteries of travel; many streets were limited to one-way traffic.

Further advances were made in 1952 when voters approved the construction of a West Side subway and additional superhighways into the city. The huge Congress Street Superhighway connecting the West Side with the Loop was to be completed by 1956.

More space for the growth of the central business district has been provided by permitting the construction of business buildings over railroad tracks and terminals. The Chicago Daily News Building and the great Merchandise Mart were among the first structures built over the "air rights" of railroads.

The crowding of the Loop caused smaller business districts to spring up in outlying neighborhoods. These are much like independent cities, often having their own newspapers and business associations. Some of the large Loop stores have branches in these neighborhoods. Many of these shopping centers serve populations as large as such cities as San Francisco, Cincinnati, and Milwaukee.

The Far-seeing "Chicago Plan"

The development of the so-called "Windy City" has proceeded according to a bright dream of city building called the "Chicago Plan." This grew out of the great World's Fair of 1893 held in Jackson Park. The striking beauty of the Fair buildings and grounds—the work of Daniel H. Burnham and other noted architects—so impressed leading citizens that a program for Chicago's esthetic development was begun.

In keeping with the city motto—"I Will"—much of the Chicago Plan has already been accomplished. A magnificent boulevard skirts Lake Michigan nearly the length of the city. About 35 miles long, it borders Jackson and Burnham parks south of the Chicago River and Lincoln Park north of the river.

Chicago has built more than 200 miles of boulevards. A network of them links together the city parks. Others lead beyond the city to the forest preserves of Cook County; and still others join the various tracts of the preserves. Here are 1,750 acres of rivers and lakes; 1,400 acres of golf courses; and 700

PLACES TO WHICH CHICAGOANS POINT WITH PRIDE

Places of Business

American Furniture Mart (opened 1924), housing showrooms of the nation's leading home furnishers.

Calumet Harbor, one of the nation's busiest ports.

Chicago Board of Trade (organized 1848), world's largest grain exchange.

Chicago Mercantile Exchange (founded 1919), dealing in sales and future contracts for daily carloads of eggs, onions, potatoes, poultry, butter, and apples.

Conrad Hilton Hotel (completed 1927), world's largest hotel.

Marshall Field and Company (founded 1852), one of the most famous department stores in the world.

Merchandise Mart (completed 1930), world's largest commercial building.

Midway Airport (opened 1927), one of the busiest airfields in the world.

Midwest Stock Exchange (organized 1949 from four city exchanges), financial market of middle America.

Montgomery Ward and Company (founded 1872), world's first mail-order house.

Sears, Roebuck, and Company (organized 1886), largest mail-order organization in the world.

Union Stockyards (established 1865), world's largest unit for marketing livestock and processing meat.

Places of Culture

Adler Planetarium and Astronomical Museum (dedicated 1930), first in the Western Hemisphere.

Art Institute (organized 1882), housing one of the world's finest collections of paintings, sculptures, prints, and decorative arts.

Chicago Academy of Science Museum (built 1893), portraying the natural history of the Chicago region.

Chicago Historical Society Museum (opened 1932), containing materials pertaining to national and local history.

Chicago Natural History Museum (founded 1893), one of foremost museums of anthropology, ethnology, geology, zoology, and botany.

Chicago Public Library (opened 1897), having about 60 branches and many other subbranches and deposit stations.

John Crerar Library (established 1894), internationally known scientific library.

John G. Shedd Aquarium (opened 1930), containing about 10,000 living specimens of fishes, reptiles, mammals, and birds.

Museum of Science and Industry (opened 1931), containing exhibits and elaborate working models showing the application of science to industry.

Newberry Library (established 1887), world famous for collections of rare books, Americana, American Indian culture, and genealogy.

Oriental Institute of the University of Chicago (opened 1931), housing great collection of materials of the ancient civilizations of the Near East.

Places of Interest

Buckingham Memorial Fountain (dedicated 1927), having 45 million candle power of colored lights.

Garfield Park Conservatory (opened 1907), largest in the world under one roof.

Hull House (opened 1889), one of America's first settlement houses (*see* Addams).

Lincoln Park Zoo (opened 1868), attracting as many as 100,000 visitors a day.

Medical Center (built around Rush Medical College, established 1837), one of finest in the nation.

Palmolive Beacon (built 1929), having 2 billion candle power.

Soldier Field (completed 1923), one of largest stadiums in nation, with a seating capacity of 102,000.

Water Tower (built 1869), sentimental reminder of days before the great fire of 1871.

Places of Education

Chicago Teachers College, founded 1867.

DePaul University, founded 1898.

George Williams College, founded 1890.

Illinois Institute of Technology, founded 1940.

Loyola University, founded 1879.

Mundelein College, founded 1930.

Northwestern University, Chicago Campus, opened 1926.

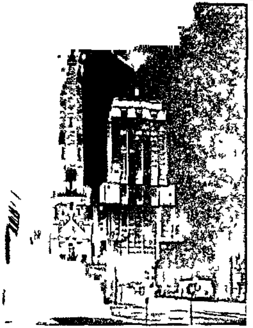
Roosevelt College, founded 1945.

St. Francis Xavier College for Women, founded 1912.

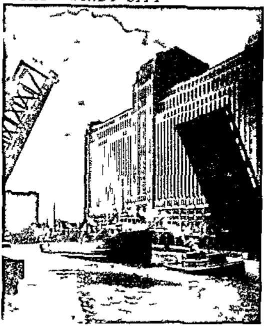
University of Chicago, founded 1890.

University of Illinois—graduate schools, opened 1896, Navy Pier Branch, opened 1946.

FAMOUS LANDMARKS IN THE "WINDY CITY"



Chicagoans are proud of their old Water Tower noted survivor of the 1871 fire To the north along Michigan Avenue is the brilliant beacon atop the Palmolive Building



The Merchandise Mart is the largest commercial building in the world Passing under one of the many drawbridges over the Chicago River is a lake freighter towed by a tugboat.

acres of zoological and botanical gardens These recreation centers include about 40 000 acres (*See* Parks and Playgrounds)

A notable result of the Chicago Plan was the construction of Wacker Drive along the south bank of the river Crumbling old business houses and factories were torn down and an unsightly commission market was moved westward Wacker Drive was double-decked with an upper and lower level

Chicago has jealously guarded its front yard Grant Park from commercialization by permitting only civic enterprises to be built there Grouped here are the Art Institute the Goodman Memorial Theatre Natural History Museum Shedd Aquarium, Adler Planetarium and Soldier Field

City of Skyscrapers and Conventions

Tradition credits Chicago with being the birthplace of the skyscraper in 1884 (*see* Building Construction) Today the city has a magnificent array of these structures chiefly in the Loop and along Michigan Avenue A city ordinance limits the height of buildings to 264 feet but allows higher setback towers which do not cut off light and air from adjoining structures From the lake the array of skyscrapers looks like a huge man made mountain range At night gleaming lights in these soaring buildings make a sky line of unsurpassed beauty and grandeur

The pinnacle of the city's lights is the 2-billion-candle-power revolving beacon atop the Palmolive Building 600 feet above Michigan Avenue It can be seen by aviators at a distance of from 150 to 500 miles

Chicago is one of the country's greatest convention cities Presidents nominated in political conventions here were Lincoln (1860) Grant (1868) Garfield (1880) Cleveland (1884 and 1892) *Benjamin Harrison* (1888) Theodore Roosevelt (1904) Taft (1908) Harding (1920) F D Roosevelt (1932 1940 1944) and Eisenhower (1952) Every year Chicago is host to about a thousand conventions and trade shows The *International Livestock Exposition* held annually in the Chicago Convention Building and International Amphitheatre is of interest to all farmers and stockmen

Soldier Field an outdoor stadium in Grant Park seats more than 100 000 persons and the Chicago Stadium on the near West Side seats 25 000 persons in a big hall Wrigley Field home of the Cubs Chicago's National League baseball team seats about 38 000 Comiskey Park home of the American League White Sox seats about 50 000

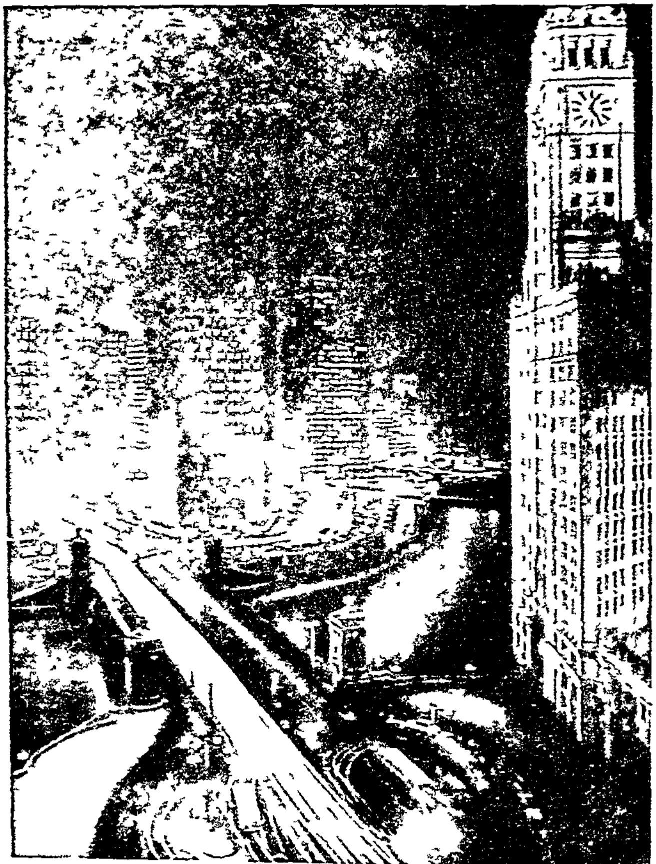
Education and Culture in Chicago

Artistically and intellectually Chicago holds high rank In the city are many well known institutions of higher learning (*see* preceding page) The city itself maintains a normal college and three junior colleges The gigantic Medical Center built on the West Side during the 1940 s and 1950 s has helped to make the city a world leader in medical education and research The multimillion-dollar project was constructed around Rush Medical College

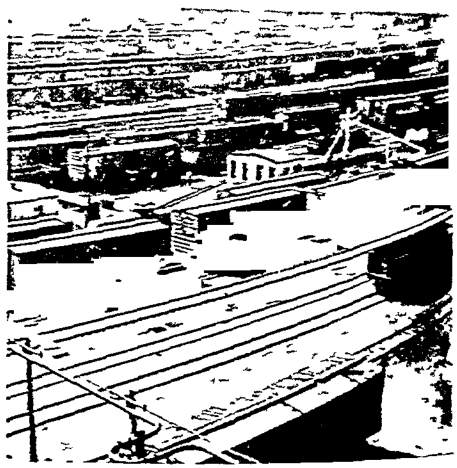
Chicago is also the music center of the Middle West Theodore Thomas founded the Chicago Sym

TOURING THE LARGEST CITY IN THE MIDWEST

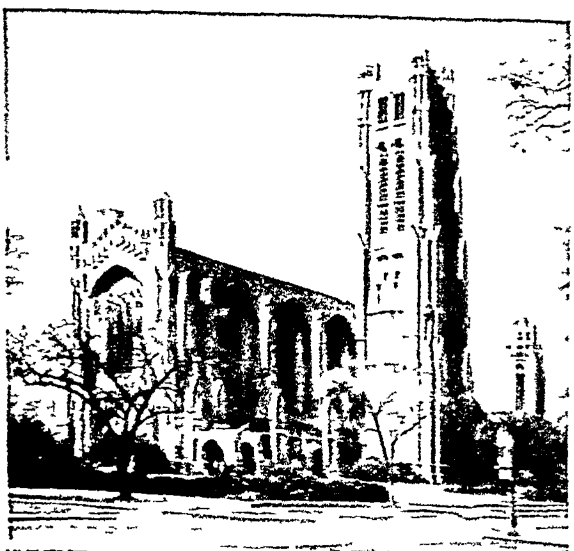
MAXWELL STREET PUSHCART MARKET



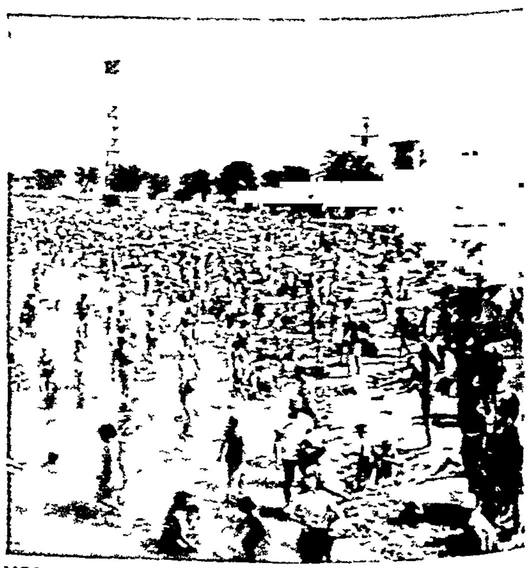
AUTOMOBILE HEADLIGHTS FLOOD MICHIGAN AVENUE



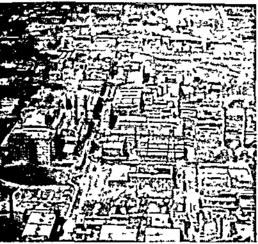
PROVISO FREIGHT YARDS



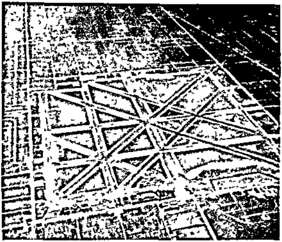
UNIVERSITY OF CHICAGO'S ROCKEFELLER CHAPEL



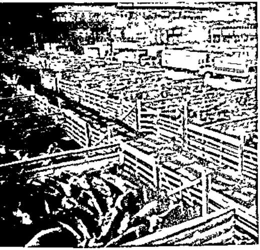
NORTH AVENUE BEACH



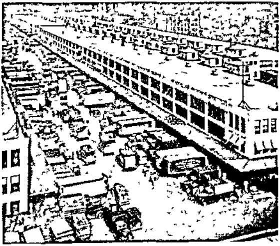
"PACKING TOWN" INDUSTRIAL AREA



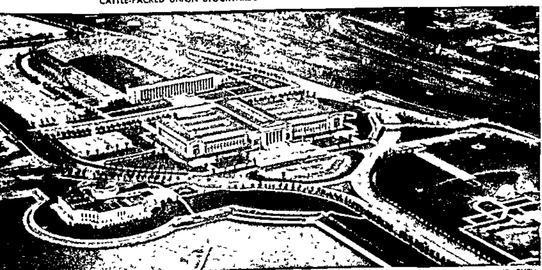
SPIDER-WEB PATTERN OF MIDWAY AIRPORT



CATTLE-PACKED UNION STOCKYARDS



WHOLESALE FRUIT AND VEGETABLE MARKET



GRANT PARK'S SHEDD AQUARIUM, CHICAGO NATURAL HISTORY MUSEUM WITH SOLDIER FIELD BEHIND IT, AND BAND SHELL

phony Orchestra in 1891 and conducted it until his death in 1905. Music lovers throng Orchestra Hall to attend the series of concerts given by the orchestra during the winter and spring months. In summer, Chicagoans enjoy outdoor concerts in Grant Park and in Ravinia Park north of the city.

The city supports four daily newspapers that have a circulation of more than half a million each and more than 40 radio stations (AM and FM). After the second World War four television stations were constructed; an additional six channels were allotted the city in 1952.

How Chicago Is Governed

Chicago's mayor-council form of government was established by the city charter granted in 1837. The mayor is the chief executive. He is elected for a four-year term. Members of executive boards, departments, and commissions are appointed by the mayor and approved by the council.

The City Council acts as the legislative branch of government. It consists of 50 aldermen, one popularly elected from each of the city's wards. The judicial branch of the city government is the Municipal Court, composed of an elected chief justice and 36 appointed associate justices.

The city operates three major public enterprises:

1. Chicago Housing Authority builds and manages public housing projects.
2. Chicago Land Clearance Commission acquires slum areas and sells the land for redevelopment.
3. Chicago Transit Authority manages the city's transportation system.

In addition to the city government, Chicago citizens are served by five other independent government bodies, each having the power to levy taxes:

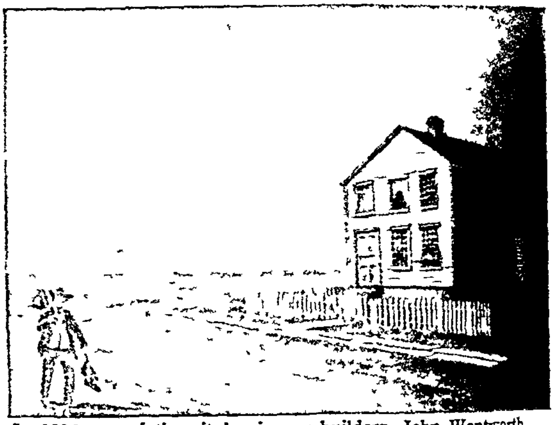
1. Board of Education administers the city school system from kindergarten through junior college.
2. Chicago Park District manages the city's parks and many miles of boulevards and lake shore. It has its own police system.
3. Sanitary District operates the disposal of sewage in the Chicago area.
4. Cook County Forest Preserve District supervises about 40,000 acres of wooded recreation areas.
5. Cook County government enforces state laws in Chicago and in 28 adjoining townships. The chief agency is the Board of Commissioners (10 of the 15 members are elected by Chicago voters).

Other county functions are conducted by the state's attorney, sheriff, coroner, assessor, clerk, and treasurer. Courts of justice include the First District Appellate Court; Superior and Circuit Courts (including Criminal Court), which have identical jurisdiction; a county court; and a probate court.

From Discovery to Fort Dearborn Massacre

In 1673 two French explorers, Louis Joliet (Jolliet) and Father Jacques Marquette, paddled their canoes down the Chicago River to its mouth at Lake Michigan. They were the first white men to visit the site of Chicago. Six years later La Salle traveled the same route. La Salle called the place by its Indian name

STATE STREET—THEN AND NOW



In 1836 one of the city's pioneer builders, John Wentworth, trudged barefoot up a wide country road into Chicago.

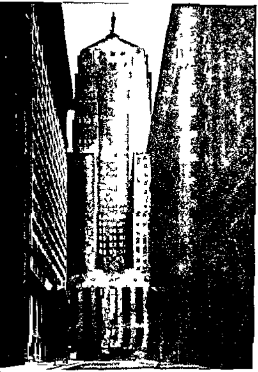
Today that road is State Street, one of the most famous retail shopping centers in the world.

Checagou, meaning "place of the skunk" or "wild onion" (another translation, "great" or "powerful").

Although many fur traders passed through the area no permanent settlement was made for a hundred years. Then about 1780 Jean Baptiste Point du Sable (also spelled de Sable or au Sables) built a cabin on the north bank of the river. Du Sable, born of French and Santo Domingan parentage, developed a large trade with the Potawatomi and other Indians of the region. In 1800, however, he sold out for $1,200 and departed.

CITY REBUILDS AFTER FIRE

Panic-stricken Chicagoans flee across Randolph Street Bridge toward the lake to escape the terrible fire of 1871



Board of Trade Building on La Salle Street symbolizes the modern city that arose from the ashes of the fire

Meanwhile in 1795 the Indians had signed the Treaty of Greenville (Ohio) ceding the area to the United States In 1803–4 Fort Dearborn was built by Capt John Whistler grandfather of the noted painter James Whistler The following year John Kinzie an energetic Scotsman took over Du Sable s old cabin and began a prosperous trade with the Indians Soon a dozen cabins were erected in the shadow of the fort They housed the Kinzies a few French families discharged soldiers and farmers

When the War of 1812 broke out the American post at Mackinac Michigan Territory was easily captured by the British and their Indian allies General William Hull American commander at Detroit then ordered the evacuation of Fort Dearborn ' provided it can be effected with a greater prospect of safety than to remain This provision however was mysteriously missing from the message received at Chicago The uneasy garrison abandoned the post and set out for Fort Wayne Ind on the morning of Aug 15 1812 They were attacked almost at once by a Potawatomi war party *Fifty two were killed—12 militiamen* 26 soldiers 2 women and 12 children The others were captured—29 soldiers 7 women and 6 children—and later died in captivity or were released for ransom The Kinzies being friendly with the Indians were spared The post was burned down

Growth of a Frontier City

Four years later Fort Dearborn was rebuilt Kinzie returned and some settlers arrived but growth was slow During the 1830 s however there began a mushroom growth unmatched by any city in the world The area had been cleared of Indians A harbor had been made by cutting through a sand bar at the mouth of the river The frontier was moving westward and thousands of Easterners arrived by wagon and by boat

In 1837 when Chicago became a city its future was assured New farms were being carved out of the nearby prairie and the marvelously fertile soil was yielding large crops Wheat from miles around began pouring into the city Grain elevators sprang up along the river banks and an endless procession of brigs and schooners carried wheat to Buffalo Cattle and hogs came from the prairie farms to Chicago slaughter houses where they were packed into barrels for shipping to markets as far away as London (*See* Meat Packing)

Industries were established and surplus manufactures found eastern markets Brigs brought lumber down the lake and Chicago became one of the largest lumber markets in the nation Rush Medical College was founded in 1837 and soon a city hospital followed Free schools were established in 1841

The Illinois and Michigan Canal was opened in 1848 connecting the Chicago River with the Des Plaines River at Joliet The new water highway brought grain and meat to Chicago that would have gone to southern markets By 1850 the thriving young city was handling ten times as much grain as New Orleans

Coming of Railroads and the Big Fire

Merchants in Chicago had argued against railroads They wanted farmers to bring in their products in person so that the visitors would spend their money here When rail transportation arrived in 1848 however it brought even greater prosperity Chicago became a vast wholesale market destined to supply 23 states Between *1840* and *1850* Chicago s population had risen from 4 470 to more than 29 000 and within the next decade it sprang to almost 110 000

Although Chicago s economic structure was built on a firm foundation its houses were set upon mud Its

marshy site was so unhealthful that in the early 1850's the death rate was extremely high. In 1855 Chicago met the challenge and raised the level of the whole city between 12 and 14 feet, filling the marsh with sand and clay dredged from the river channel.

On Oct. 8, 1871, came the great fire. It started in a barn on De Koven Street. Three and a quarter square miles, including the entire business district, were destroyed. In the 27 hours the fire raged, 17,450 buildings were consumed, including 1,600 stores, 60 factories, and 28 hotels and public buildings. About 250 lives were lost, and the property loss was nearly 200 million dollars. Rebuilding began almost before the embers had cooled. Within two years a new city of brick and stone had arisen from the ashes.

Labor Troubles and Other Disasters

Rapid industrial growth led to many labor disturbances. A strike at the McCormick harvester works culminated in the Haymarket riot of May 4, 1886, in which a bomb killed seven policemen and injured many more. Four men accused of inciting the riot were hanged; three others who were sentenced to prison were pardoned in 1893 by Gov. John P. Altgeld.

Again in 1894 Chicago was the center of a nationwide strike of Pullman workers. President Cleveland sent troops into the city, over the protest of Governor Altgeld. In 1937 ten strikers were killed in a clash between workers and police at the plant of the Republic Steel Company. Other tragic episodes in the city's history were the Iroquois Theater fire in 1903, in which 596 persons lost their lives; and the sinking of the *Eastland* excursion boat in the Chicago River in 1915, with a death toll of more than 800.

Chicago Becomes an International City

Chicago's first world's fair was the Columbian Exposition of 1893. The fair, opening a year late, celebrated the 400th anniversary of Columbus' discovery of America. In the years following the first World War the city had its greatest growth, increasing its population more than two thirds of a million between 1920 and 1930.

During the 1920's Chicago made headlines with its gangsters' wars, gaudy funerals for hoodlums, and the clowning of its mayor. Meanwhile great achievements received little attention—skyscrapers rose in the Loop and along Michigan Avenue; parks were beautified and enlarged; and boulevards were built or extended.

In 1933–34 Chicago held its second great world's fair, the Century of Progress, commemorating its 100th anniversary as an incorporated town. The buildings were erected on land taken from Lake Michigan by filling in along the shore. The Railroad Fair of 1948–49 occupied the same ground.

The first atomic pile in history was activated at the University of Chicago, Dec. 2, 1942. Four years later Argonne National Laboratory was opened at the University of Chicago. Some installations are now in Du Page County west of the city.

In 1953 two outstanding construction projects were being built in the city. One was the 101-acre Lake Meadows housing project on a former South Side slum area. The other was a huge Loop office building, the first Chicago skyscraper to be built in almost a quarter century. It was being erected by the Prudential Insurance Company on the "air rights" of the Illinois Central Railroad.

CHICKADEE. The gay, acrobatic little chickadee is one of the friendliest of birds. In the summer it lives in the woods, gathering caterpillars and moths for its young. Instead of traveling south in winter, it makes its home in orchards and in the trees of city streets. With the offer of suet or unsalted peanuts it can be persuaded to eat out of one's hand.

In its efforts to pick seeds and insects from anywhere on a tree, the chickadee seems to be equally at ease upside down or sideways. With its glossy black cap and throat, gray coat, and white vest, it could be very handsome if its constant gymnastics didn't give it a ruffled, disorderly appearance. The male and female look alike. The cheery call *chick-a-dee-dee-dee* is often abbreviated to *dee-dee-dee*. Less familiar is the song of two or three notes, which is frequently mistaken for that of the phoebe. The naturalist Henry Thoreau compared it to "the tinkling of icicles on the grass."

The chickadee nests in a hole in a tree or stump, which it lines with moss, grass, feathers, and plant down. Here it lays six to eight eggs. They are white spotted with ruddy brown. The bird defends its nest with an odd trick that startles even human intruders. It takes a breath so deep that the body swells and then suddenly exhales with a popping sound.

Chickadees belong to the titmouse family *Paridae* (*see* Titmouse). They vary in size from 4 to 5¼ inches. The black-capped chickadee (*Penthestes atricapillus*) ranges throughout the northern and central United States. It is the state bird of New Hampshire (unofficial), Maine, and Massachusetts. The Carolina chickadee (*P. carolinensis*) nests in the southeastern United States, chiefly the Gulf states. It is smaller than the black-capped, and the song is higher pitched and more lively. The mountain chickadee (*P. gambeli*) and the chestnut-backed (*P. rufescens*) are western species. The Hudsonian, or Acadian, chickadee (*P. hudsonicus*) of Canada and Alaska and the chestnut-backed have brown markings instead of black.

THE CHEERY CALLER OF "DEE-DEE-DEE"

Resting on a small twig is this gay little black-capped chickadee. It is looking into its home, a comfortably lined hole in the gnarled limb of a tree.

How to Help CHILDREN GROW UP

A child s relationships with his parents shape his whole life Parenthood is an important job It is also fun and is done best when most enjoyed

CHILD DEVELOPMENT Through the centuries many strange bel efs called old wives tales have grown up about children Most of these ideas have been found to be in direct contrad ction to scientific truths If it were not for the cont nuing bel ef in these tales they could be regarded as curiosit es of the past and not taken seriously

During the past hundred years stud es of children have been made on such a wide scale that they have touched every aspect of the child s l fe Through these studies we have learned many basic facts about how children grow and develop Parents and teacl ers who know and use the informat on can help children to reach maturity as well-adjusted healthy and competent citi zens Parents who disregard tl e facts rear problem children to a troubled adult life

Basic Facts in Child Development

The child is not a miniature adult Look at any child and you will see that his body is not just a small copy of an adult s body His proportions are different and he lacks many of the features of mature people Mentally he is dif ferent also Until he is an adult adult behavior can not be expected of him and he should not be judged by adult standards

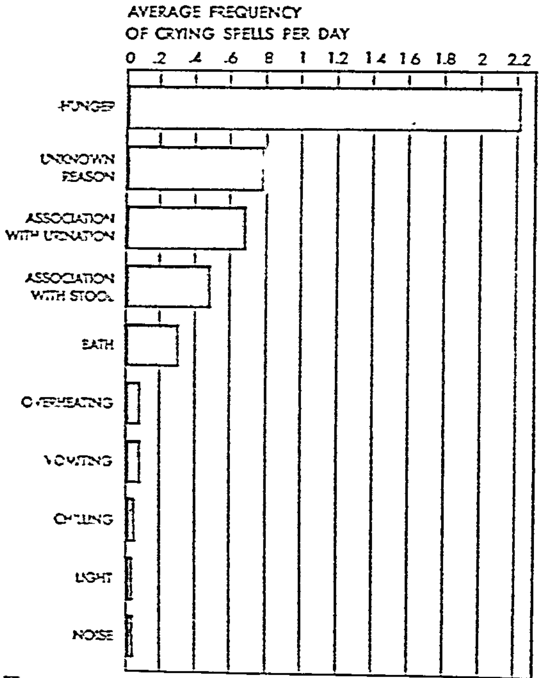
Children both grow and develop Growth means in crease in size Development by contrast means a progressive series of changes in proportions physical features and behavior The two processes go on simul taneously While the child is growing in stature he is also developing a mature mind and body

Childhood is the foundation period of life The foundat ons laid in ch ldhood determ ne what a person will be in adult life both physically and mentally Tra ts acquired in early childhood—both desirable and undes rable—are likely to persist Many parents make the mistake of thinking that undesirable traits will be outgrown and that some experience doesn t count because the child is so little Children do not outgrow undesirable traits On the contrary most of them persist practically unchanged into old age although they may then be cloaked in more mature and subtle disguises This of course does not mean that traits can never be changed They can be but only when a person has a strong desire to change and knowledge of how to bring the change about

Each child is different Partly because of heredity and partly because of environment each ch ld is a d stinct and different individual One cannot treat all children alike and hope to get the same results

Development comes from maturation and learning Maturat on is the unfolding of hered tary traits not fully developed at b rth This is nature s fo indation On it the child must build through learning the physical and mental abilit es needed for successful living Learning cannot take place until the founda t ons are laid The child cannot for example learn to feed himself until his muscles have reached a cer tain stage of development and his nervous system has matured to the po nt where co-ordinated movements of hand and arm are poss ble Any attempts to teach a ch ld to do something before he is ready to learn it is doomed to failure Moreover such attempts d s-courage the child and make later learning at the right age difficult

Development is rhythmic not regular Phys cally and mentally the child grows and develops by fits and starts The brain for example reaches nearly its mature size by the time the child is six or seven years old but the internal development of the nerve centers is not complete until the late teens or early twent es The developmental pattern also is rhythmic



Hunger causes a baby to cry, on the average, about twice a day. Light or noise will make him cry only once in a hundred days.

not regular. At a given time one ability may be acquired fast while another is developing very slowly.

Periods of Development in Childhood

Infancy. From the moment of birth to the age of two weeks, the infant is making adjustments to life outside the mother's body.

Babyhood. From two weeks to two years, the baby is learning to control his body, thus decreasing his helpless dependency upon others.

Early childhood From two to six years, the child is learning to control his environment, thus further decreasing his dependency.

Late childhood. From six years to puberty, the child is learning to get along with people and to be a social being.

Puberty. From about 10 or 11 to 13 or 14 years, sexual development is taking place, bringing with it a new body, new interests, and new behavior.

Adolescence. From 13 or 14 years to about 21 years, the young person is adjusting to adult life and preparing for his lifework and marriage.

The Newborn Infant

An infant at birth is not a rosebud beauty. His body looks disproportioned, with head much too big and arms and legs much too small. His skin is likely to be wrinkled or blotched and may even have some hair on it. His head may be misshapen and his trunk has a potbellied look.

Sense organs. The newborn infant's sense organs look as if they were fully developed. Scientific studies have revealed, however, that he sees nothing clearly because his eye muscles are too weak to focus on an object. He is totally color-blind because the interior of his eye is undeveloped. Sounds cannot penetrate because the inner part of the ear is clogged with mucus from the sac in which the baby developed before birth. Taste, smell, touch, and sensations of hot and cold are, by comparison, well developed, though far from their mature level of functioning. There are no indications that an infant can feel pain for several hours after birth.

Vocalization. An infant cries when he comes into the world. This "birth cry" inflates the lungs and starts the breathing process. During the two-week infancy period his cry may vary in intensity but there will be little change in tonal quality. It is therefore difficult to tell why he cries—whether because he is hungry, cold, thirsty, hot, soiled, tired or in pain. In addition to crying, the infant coos, gurgles, sighs, sneezes, and hiccups.

Physiological functions. The infant sleeps, eats, and eliminates, but even these functions are imperfectly developed. His sleep is fitful, broken by pain or hunger every few hours. Sucking and swallowing are so undeveloped that he has difficulty in taking his food for several days or perhaps for weeks after birth. He must learn to co-ordinate his sucking with his swallowing and this takes practice.

Activity. The infant's body is in constant motion. Even when he is asleep he is almost never still. The most active parts are the head and arms; but because his nervous system is undeveloped, when one part of his body moves, the rest moves too. This random *mass activity* is very tiring. It is particularly tiring when he cries, because then he is most active. Reflex equipment is almost fully developed at birth.

Personality. Personality begins to form at birth. Many factors—including the type of birth experience the infant has had—combine to form his distinctive personality pattern. The amount of love and care he receives in the early days of his life is of tremendous importance in setting the foundation for his later personality.

Prematurity. Today, owing to modern medical methods, most prematurely born infants not only survive but have as good a chance for a normal life as have the full-term infants. For the first two or three years of their lives they may lag behind in their physical and mental development, but they do catch up and, from then on, develop like all other children. There is no scientific evidence that they are any weaker or more likely to be mentally deficient than the average run of the population. If, however, their parents believe tales about the handicaps of prematurity, the children are likely to be more nervous and will therefore make poorer social adjustments than other children.

Physical Growth and Development

There is a close relationship between physical and mental growth. A bright child usually grows faster than a dull child. He is also likely to be healthier and better adjusted to life. Physical development, in turn, determines what a child can do. He cannot, for

example play football or baseball until his body is strong his muscles co-ordinated and his brain sufficiently developed to permit quick thinking Physical deficiencies such as blindness and deafness or some abnormal physical condition such as obesity will profoundly influence the child's whole pattern of behavior The fat child for example is cut off from play with other children because he cannot move quickly He may withdraw and develop an "I don't care" attitude or he may retaliate against his thinner playmates by criticizing and scorning them

Height and weight Children vary so greatly in rate of growth that it is possible to give only a rough pattern of height and weight increases of American children today

A baby usually doubles his birth weight at the end of four months and trebles it at the end of one year If he weighs seven pounds at birth he will weigh approximately 14 pounds at four months and 21 pounds when he is a year old During the next nine or ten years the annual increase will be from three to five pounds At six years the child should be approximately five times his birth weight or 35 pounds At the beginning of puberty he should weigh between 55 and 65 pounds Boys are usually heavier than girls

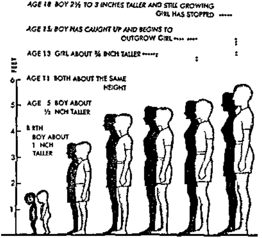
The pattern for height closely parallels the pattern for weight If a baby boy measures the usual 20 inches at birth when stretched to full length he will measure at four months approximately 23 inches and at one year 28 or 29 inches (The average length for girls at birth is 19 inches) From one year to puberty the annual increase is about three inches This means that by six years of age the child's height will have doubled and at 12 he will have nearly trebled his birth measure

Body proportions The infant's body gradually changes The face enlarges as do the facial features but at six or seven years the face is still immature The neck grows longer so that the head no longer seems to sit on the shoulders The shoulders broaden as does the lower part of the trunk The arms and legs lengthen but remain spindly until adolescence Not until physical growth is completed in late adolescence does the body have mature proportions

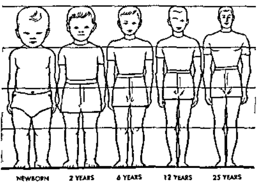
Bones and muscles Bones gradually harden and muscles grow stronger Throughout childhood however the bones remain so soft that they can easily become misshapen if the child develops faulty posture carries heavy bundles or rides another child piggy back The muscles also are weak Too much strain on them will bring on fatigue accompanied by irritability and may even impair health

Teeth Most babies have at least one tooth by the time they are six months old From then until two and one half years of age teeth come in one at a time until all 20 of the baby teeth have erupted By the sixth birthday one or two of the baby teeth usually have been replaced by permanent teeth and the four six year molars have appeared behind the primary teeth Children vary so widely in the time their teeth appear that no particular concern should be felt if

PATTERNS OF GROWTH AND DEVELOPMENT



For the average child growth comes in spurts followed by periods of slow increases in both height and weight



Marked changes occur in body proportions during the growth period These changes are completed during adolescence

teeth are cut late The eruption of baby teeth is usually accompanied by salivation loss of appetite chewing and irritability Permanent teeth except in the back of the jaws come through with no appreciable discomfort (*See also* Teeth)

Physiological functions Eating sleeping and elimination gradually become systematized with the maturing of the nervous system and with practice By the time a child is two years old he is usually able to bite and chew so that he can eat adult food sleep through the night, and control elimination from the bowels A year or two later elimination from the bladder is usually under control also

Sense organs As the eye muscles strengthen the eyes begin to focus and give clear vision Throughout childhood however the eye muscles remain weak and they can become permanently damaged by continuous use of the eyes at a fixed distance Reading with poor posture or in poor light may also be harmful Hearing is acute during childhood but the ears are subject to temporary or permanent damage because they are so

close to the nose that mucus from the nose can clog them. Smell and taste are keen. Sensations from the skin of pain, pressure, hot, and cold are likewise keen because the child's skin is thin and the sense organs are close to the surface. A scratch or blow that would seem trivial to an adult may be really painful to the child.

Health. Childhood is a period of many diseases. The usual children's diseases, as well as colds, stomach upsets, earaches, infections, eye and teething troubles, and orthopedic defects, should have prompt medical attention. When a child is sick, he misses school and cannot play with his friends He is likely, therefore, to receive extra attention or pampering at home. Frequent or prolonged illness saps his strength and retards his growth. It is also likely to damage his personality and affect his adjustments to people even after the illness is over. Good health enables a child to develop both physically and psychologically in a wholesome way. (*See also* Health.)

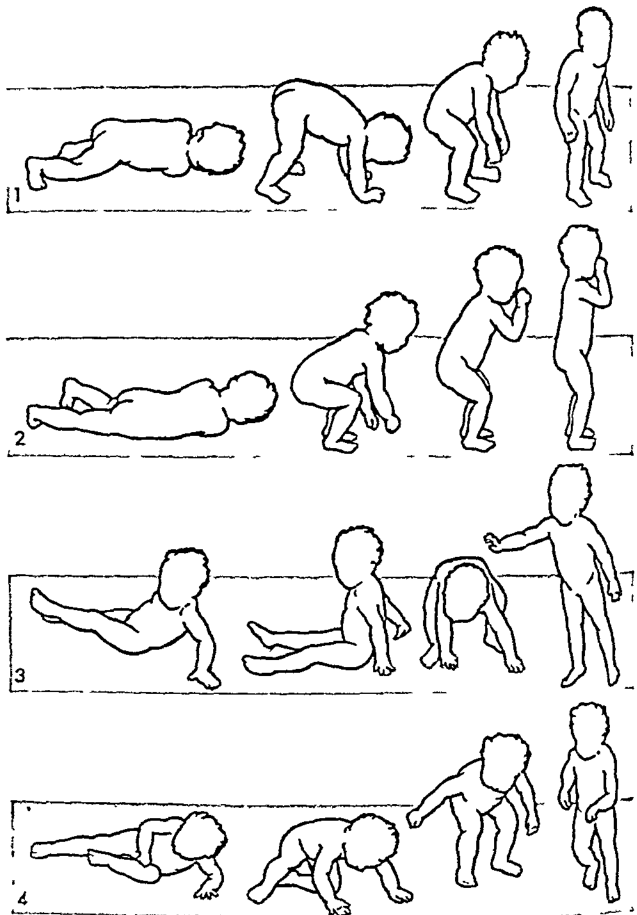
The Development of Bodily Activity

The newborn infant gradually overcomes his helplessness as his muscles develop and co-ordinate. Control sweeps over the body from head to foot, with the eye muscles coming under control first and the leg muscles last. This growing control is made possible by maturation of the brain centers and muscles and is perfected by practice. By the time a baby is a year old he can sit, stand with support, take a few steps when holding on, and reach for objects he wants. When he is two, he can walk, climb, jump, ride a kiddy car or tricycle, play with rather complicated toys, feed himself partially, pull off his clothes, and even put some of them on. He is no longer helpless.

Once the whole body is brought under control, the next step is to learn useful skills. Each nation has its own skills and passes them on to the children. The skills that American children are expected to acquire at different ages are listed in the section "How to Train Children for Independent Living" at the end of this article. It is essential that a child be given opportunities to learn these skills at the time his contemporaries are learning them so that he can do what other children do and fit into the school and neighborhood group. Because children's social contacts are based on play and their play is based on skills, the child who lacks the skills of his contemporaries becomes a social misfit.

Good learning requires guidance. For example, when a child is first learning to grasp, he may use his left hand in preference to his right. Unless guided in learning to use the right, he will develop left-handedness, thus making it difficult to follow the patterns of learning designed for right-handed people. If, however, a child shows a strong left-hand preference that is apparently not the result of learning, changing to right-handedness is not recommended.

FOUR STAGES IN LEARNING TO STAND UP



When his bones have hardened and his muscles have strengthened, a baby learns to control his muscles so that he can get up easily and keep his balance.

How Speech Develops

Long before a baby can talk he can let others know what he wants. His cries take on different tonal qualities so that it is fairly easy to interpret them. He also uses simple gestures, such as pointing and pushing, to indicate what he wants or does not want Crying and gestures are useful so long as the baby cannot talk. Their use should be discouraged when he is able to convey his meanings by words.

Around the third or fourth month, coos and gurgles develop into babbling. Babbling is called "play speech" because it is not used to convey meaning. The baby amuses himself by babbling when he is alone and he gets much pleasure from listening to himself, as may be seen from the way he laughs at his sounds. Each month the baby spends more time babbling and the combinations of sounds become more varied.

Some of the babbling sounds originate with the baby through trial and error. Others are imitations of

speech sounds he hears Toward the end of the first year he begins to combine babbling sounds to form simple words mimicking the words he hears others use In addition to making the correct sounds he must learn the meaning of the words he uses or his talk will be parrot talk and not real speech

Four Major Tasks in Learning to Talk

Associating meaning with words The child must know the meaning of the words he uses and must also comprehend the meaning of words he hears others use Comprehension vocabulary is larger at every age than speech vocabulary Children sense the meaning of *many words they hear or read but in too vague and* indefinite a manner to use them

Building a vocabulary A child learns words as he needs them He first learns nouns that name people and objects because these words are most useful to him Then he learns action verbs such as go and give and adjectives that describe his feelings toward things such as nice and bad Adverbs prepositions and conjunctions come next and last of all pronouns He learns words of general usage *such as man and cat before words of specific* usage such as names of colors and coins How large his vocabulary will be at any age will depend upon his intelligence his need for new words and his opportunities to learn He will learn many words if he is with people who use large vocabularies

Pronunciation It is hard for a child to pronounce words correctly He must hear the word clearly and distinctly and then co-ordinate the muscles of his tongue and lips to produce the sounds One-syllable words are usually learned quickly and pronounced correctly Longer words are harder to master Baby talk is mispronunciation of words It may develop *into a habit if adults mimic the mispronunciations* because they think they are cute

Forming sentences The first sentences a child uses are combinations of a noun or verb with a gesture Ball for example when combined with outstretched arm means Give me that ball By his second birth day the child is usually using sentences Early sen tences are generally long and rambling with several thoughts loosely joined with and and but They contain many grammatical mistakes which if not cor rected are likely to develop into habits

***Common Speech* Defects of Childhood**

Speech defects should be corrected when they first *appear because it becomes increasingly* difficult to correct them as the child grows older

Lisping Almost all children lisp or soften harsh sounds such as *r z* and *s* when the front baby teeth come out because there is then no sounding board for these consonants When the permanent *teeth appear* the habit may persist Practice in saying words cor rectly generally corrects lisping

Slurring Running words together is slurring Slur ring is most likely to appear between the ages of three and eight years It comes from excitement which makes the child speak too fast to pronounce each word clearly and distinctly It can be easily cor*rected* by *encouraging* the child to slow down and speak so that he can be understood

Stuttering Repetition of syllables or words is stuttering Stuttering is caused by nervousness With tension the vocal muscles tighten up In his attempt to speak smoothly the child repeats what he has already said Stuttering is usually accompanied by stammering (*see* below) and should be corrected in the same way

Stammering Stammering is a deadlocking of speech or choking on words Like stuttering it comes from nervous tension It can usually be cor rected by *keeping the child s environment as free as* possible from excitement and by removing pressures *on* him to hurry up or to do more than he is capable of doing If these measures do not succeed the child should have the help of a speech corrective expert

Understanding a Child s Emotions

The infant is born with few and very undeveloped emotions As he grows older his emotions develop from maturation and from learning Soon he learns to associate fear anger joy and other emotions with people and with objects that give him pleasant or unpleasant experiences

A child s emotions are different from an adult s They are more violent and more overtly expressed in

HAVING FUN WITH A SECRET LANGUAGE

OPISH

To talk Opish add the syllable *op* after each con sonant of a word leaving the vowels (a e i o u) alone Thus Billy becomes Bopiloplopyop

Example Bopiloplopyop wopasop a fopamopousop soptopudopenoptop ofop Opopisophop

Translation Billy was a famous student of Opish

PIG LATIN

Pig Latin is formed by taking the first letter of a word and putting on the end with an *ay* after it If the word begins with a vowel (a e i o u) add *way* Thus word becomes o dway as becomes asway and so on

Example Atwhay Iway antway otay owknay isway fway Iway uybay away ittlelay igpay ancay itway earnlay Igpay Atinlay ootay?

Translation What I want to know is if I buy a little pig can it learn Pig Latin too?

A secret language gives a child privacy and a strong feeling of belonging with friends who share the strange speech with him.

speech and actions. They are also shorter lived and more quickly forgotten. The child cannot be expected to have the same control over his emotions that one expects in an adult. He has not lived long enough to develop emotional control nor does he realize that it is important. One should therefore not judge a child's emotions by adult standards or expect the child to express his emotions in an adult way.

As his social contacts broaden, the child comes to realize that he cannot give violent vent to emotions as he did when he was younger and still maintain the respect of other people. Then he will learn to turn his emotional energy into acceptable channels, such as games and sports. Forcing a child to suppress his emotions may play havoc with his health. Actually, no strong emotion can be suppressed for any length of time. Eventually it will break out in its full intensity and destroy the illusion of the child's good emotional control.

Common Emotions of Childhood

Anger. A child's anger is aroused whenever he is kept from doing something he wants to do. The thwarting may come from a person, from an obstacle in his environment, or from his own awkward act. Around the age of two he expresses his anger in violent outbursts of crying, kicking, hitting, biting, or throwing himself on the floor. Such outbursts are called "temper tantrums." When the child begins to play with other children, around the third year, he discovers that temper tantrums are considered babyish. He then learns to show his anger in more subtle forms, such as sulking, obstinacy, and contrariness.

Fear. Anything new and different, especially if it comes upon a child suddenly, may frighten him. He expresses his fear by running away and hiding or by crying for help. Later, instead of crying, he makes excuses for not doing things he is afraid of to avoid being called a "fraidy cat" by his playmates.

Jealousy. Jealousy is a combination of fear and anger. It is aroused when a child believes that the affection he has enjoyed, especially his parents' affection, is going to a rival. A young child may try to hurt the child who, he believes, has usurped his position; he may express his jealousy by being stubborn and contrary; or he may revert to infantile behavior in the hope of winning back the attention he formerly had. Older children use more subtle forms of expression. They ridicule, tease, bully, play practical jokes, or give unpleasant names to the object of their jealousy.

Envy. Envy is like jealousy except that it is aroused by material possessions rather than by a person. For example, a child may envy another child his toys, his big house, or his family's car. Envy is usually expressed by complaining about one's lot in life and wishing for things others have. In young children envy often leads to taking the possessions they envy.

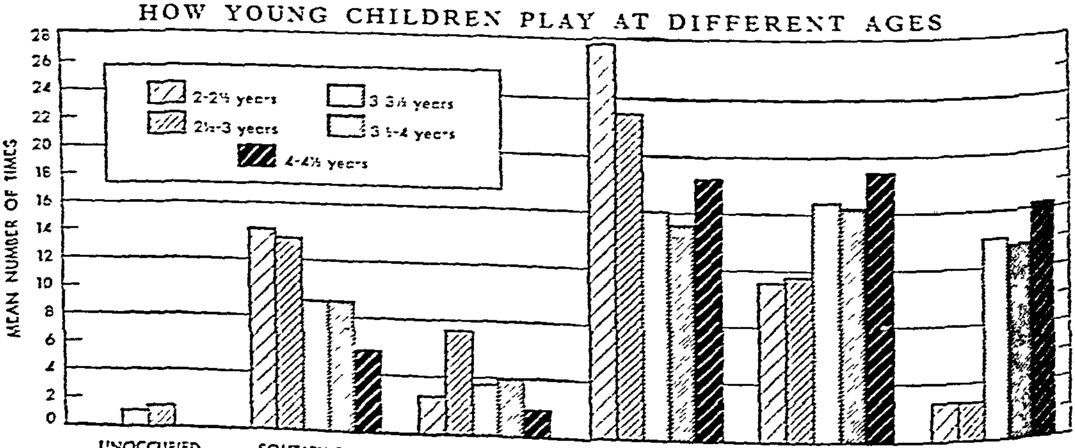
Curiosity. The same things that cause fear—the strange and unfamiliar—may arouse only curiosity if they do not come upon the child too suddenly, as fear objects do. When a child's curiosity is aroused, he explores by handling and examining, by asking questions, and finally by reading. Because curiosity is the driving force back of all learning, it should be encouraged and directed into useful channels.

Love. There is no such thing as "natural" love for mother, father, sister, brother, grandparent, uncle, or aunt. The people a child loves are those whose contacts with him have been pleasant. He will love his parents if his parents love him and show their affection. Children express their love not so much by fondling and kissing as by wanting to be with the loved one, wanting the approval of the loved one, and wanting to do things with the loved one.

Importance of Early Social Experiences

Early social experiences determine the child's attitude toward people and toward himself. His earliest social contacts are usually in the home with parents, brothers, sisters, and family friends. If these contacts have been pleasant, the child will have a

HOW YOUNG CHILDREN PLAY AT DIFFERENT AGES



The two-year-old child spends considerable time in solitary play, but his chief enjoyment is parallel play—doing what the children around him are doing, but independently. When he is three, his interest in co-operative play rises sharply.

ALL CHILDREN WANT AND NEED PLAYMATES


The young child will play with a child of the opposite sex as happily as with a child of his own sex


By middle childhood girls play with girls and boys with boys There is much secrecy among gang members

friendly attitude toward people outside the home and will want to do things with them If his early contacts have been unpleasant he is likely to try to shun people whenever possible His whole attitude toward people is likely to be unfriendly if his older brothers and sisters have teased and bullied him or if his parents have neglected him or subjected him to harsh discipline *His relationship with people will be difficult too if his parents* because of their love for him have treated him as if he could do no wrong The child expects similar treatment outside the home and is bewildered when his naughty behavior does not bring him the attention he craves

Normally the young child s early contacts outside the home are more often unfavorable than favorable If his playmates are his own age they are likely to be as self-centered as he is The result is frequent grabbing pushing hair-pulling and fighting With older children the young child is forced to play a submissive role doing what he is told

Sooner or later the child s natural desire to be liked *helps him to make adjustments to other children* He learns to give as well as to take he learns to ask for what he wants instead of snatching it and he learns he must share his possessions with others if he wants them to share their possessions with him This learning is speeded up if parents or teachers supervise the child s play and teach him how to get along with other children

At first a child plays with one child at a time Gradually he learns to get along with two or three children or even with a small group Late childhood is the "gang age" a time in life when having friends is the most important single thing To insure his place in his group the child tries to think and act as the *group does even if such behavior* is contrary to what his parents would approve He knows that if he does not conform his place in the group will be taken by a child who does He will then be an outcast and will have to depend upon adults or younger children for companionship

The type of companion a child selects depends upon his age As a baby he will prefer the companionship of adults or older children because they will give him the attention his egocentric nature craves Around his third birthday he will *want to play with children* of about his own age It makes no difference to him whether his companions are boys or girls or whether *their skin is dark or light* So long as they can do what he can do and will not fight too much with him he will like them

Once he starts to school the child s whole attitude toward his friends changes Boys do not want to play with girls and girls are therefore forced to seek the companionship of other girls A friend now must be a good sport must be able to do things as well as the rest of the group and must not be babyish Prejudice begins to creep in against certain children because of their skin color racial origin or religion

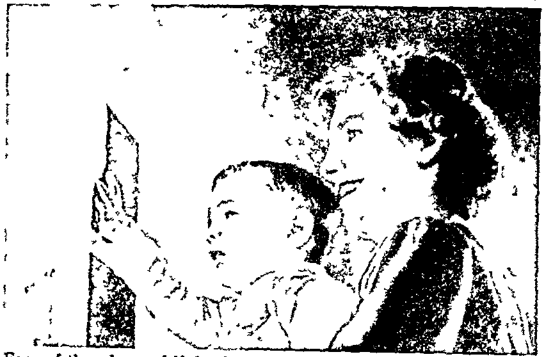
Leaders are made not born The true leader has qualities of initiative co-operativeness ability to make decisions and friendliness Children who have these qualities come from homes where a friendly atmosphere prevails They have been given independence in managing their own affairs within the limits of *their abilities They have also had opportunities for* co-operative action so that when another child wins the leadership they can be happy to be followers too By contrast *the child whose home environment is* restrictive develops a submissive pattern of behavior Furthermore he is likely to antagonize others by having a chip on his shoulder Such a child will not be popular with his fellows and will not be allowed to win leadership of the group

Three Different Stages of Children s Play

Children s play passes through different stages The pattern is the same for all children, although they mature in different cultures

Exploratory play The baby plays with his hands feet hair and any part of his body he can reach Then he explores other people his toys or anything he can lay his hands on Not much before his second

CHILDREN'S EMOTIONS MUST HAVE OUTLETS



Fear of thunder and lightning turns quickly to curiosity if a baby feels secure in mother's arms and sees that mother is unafraid.

Allow him to satisfy his curiosity when there is no danger to him or to valuable possessions. Then he will turn to something else.

Let him win the admiration of his friends by boasting of his new clothes. He will then be less likely to "show off" in other ways.

birthday does he actually play with his toys in a constructive way. This is the beginning of "make-believe" play.

The toy age. From two to six the child spends most of his playtime with his toys. He builds with sand, blocks, or clay. He dramatizes simple little scenes duplicating life activities he is familiar with, such as playing house. Outdoors, he rides tricycles, pulls wagons, and uses slides and swings. Indoors, he may amuse himself in quiet periods by looking at picture books or television or listening to the radio.

The play age. Late childhood is called the "play age." No more time is spent on play than previously, but there is now a wider range of play activities than at any other period of life (*see* Play).

Children's Interests

No two children will have identical interests. There are, however, some interests that are almost universal among American children, although they will vary in intensity. They are:

Interest in one's body. All children are curious about their bodies. They want to know what each part of the body does, why it is formed as it is, and what makes it function. At first, children will explore their bodies to satisfy their curiosity. If this does not bring them the answers they want, they will ask questions. All such questions should be answered truthfully and in a satisfying way.

Interest in the origin of new life. Most children are more interested in the origin of human life than of plant or animal life. They should be told the facts, simply and truthfully.

Interest in sex differences. By the time a child is two or three years old, he notices that his body differs from that of children and adults of the opposite sex and differs also from adults of his own sex. He wants to know why his body is different and what roles the different parts of male and female play in life. Parents should satisfy his curiosity by telling him the true names of body parts and functions.

Interest in religion. Children find it difficult to understand things they cannot see or feel. Religious teachings and stories therefore arouse more curiosity than true religious feeling. Nevertheless, because religion is an important force in life, religious teachings should be explained to the child, so far as they can be.

Interest in mechanical devices. The American child is surrounded by machines of different sorts. It is not surprising that he wants to find out how they work and how he can control them. Because he can rarely satisfy his curiosity by direct exploring he asks questions. The range of his interests frequently goes beyond the resources of his parents and leads him to seek his own answers in encyclopedias and other books. Reading stimulates further interest that can be satisfied only by more reading.

Interest in clothes. The young child finds clothes a nuisance. It takes time to put them on, they hinder his activity, and he is expected to be careful of them. When he begins to play with other children, he finds that clothes have an attention value, and he likes to have new clothes to show off. By the time he is in the first grade, he wants clothes that identify him with his friends. He is happy when he can look like his friends and utterly miserable if his clothes set him apart from his crowd. Interest in a good appearance builds up fast as childhood draws to a close and reaches a peak in adolescence.

Intellectual Development

In the early years of childhood, intellectual development is extremely rapid, just as is the growth

of the brain Imagination also develops very rapidly in the early years Reasoning and association of ideas develop more slowly Memory for specific facts develops more rapidly than memory for abstract facts

Intelligence tests Today wide use is made of intelligence tests The results of the tests are usually expressed in terms of the *intelligence quotient* or I Q (*See* Intelligence Tests Individual Differences) The I Q helps both parents and teachers to know what they can reasonably expect of a child in school It also enables them to predict fairly well what he will be capable of doing in the business or professional world and so helps them to plan his education

Nothing can increase a child s intellectual capacity significantly but many things can prevent its full development Among these are prolonged and serious sickness injury malnutrition during the growth years lack of opportunity to develop and frequent and intense emotional upsets

Types of intelligence Intelligence is not a single trait but a combination of many different mental capacities How these capacities are combined determines what *type* of intelligence an individual has

There are three general types of intelligence *abstract concrete* or *practical* and *social* Abstract intelligence enables one to deal with abstract facts This type of mental ability leads to success in school Practical intelligence or common sense is the type that helps people to deal with commonplace everyday problems Social intelligence helps a person to size up people and social situations and to know how to adjust to them successfully

It is important to find out which type of intelligence a child has so that he will not receive training that will doom him to be a square peg in a round hole There are various vocations where each type can be used to great advantage (*see* Vocations)

Family Relationships

Family relationships change as the child grows older So long as he is a helpless baby his parents love him and he loves them The baby shows his love by his pleasure at being with his parents his utter satisfaction when his bodily needs are met and his responsiveness to fondling and cuddling When he cries or fusses his parents do not blame him because they realize he is just a baby

When the child gets on his feet he begins to do some things for himself and his ways of doing them are not always to his parents liking He also begins to assert himself and will do what he is asked only if the task strikes his fancy If he is forced to do something against his will he puts up a stormy protest

As the child matures parent-child friction is likely to increase The child seeks independence beyond his abilities to cope with problems successfully When a child is *not given the independence* he craves he is likely to feel that his parents treat him like a baby that they are fussy and nagging and that it is impossible to please them with his schoolwork his behavior or his friends Some parents in turn are likely to feel that the child does not try to co-operate and does not carry his load in the home They complain that he does not appreciate the opportunities they have given him he does not try to make the most of his abilities and he seems to show more interest in outsiders than in his family When such attitudes develop it is not surprising that parent-child relationships after the early years deteriorate rapidly

BIG SISTER PLAYS MOTHER

Big sister is helping her busy mother and is also learning to be a good mother herself Her brothers enjoy her attention

Home is a happier place for the entire family when the parents understand the normal behavior of children Such parents realize that certain feelings and actions are normal for the child s level of development trying and exasperating though they may be They ask themselves why the child does what he does and they usually find that he has a reason even though it is not one an adult would accept They realize that fault-finding does not spur the child to further effort and in any case would not be worth while if it causes the child to feel he is not loved

Brother sister relationships Brothers and sisters are not always happy playmates There are times of peace and harmony of congeniality in interests and co-operation in work or play but these times are far too few in the typical family A child never quite forgets how he was pushed into the background when a younger child arrived in the family nor has he found this child the congenial companion his parents promised him Relationships are no better with his older brothers and sisters They often resent him

and insist that he do just as they say as the price for being allowed to play with them. When there are both boys and girls in the family the situation is likely to be worse because most boys develop a feeling of superiority over girls and try to lord it over their sisters. Each child, moreover, invariably imagines—often quite wrongly—that his parents have favorites and that he is never the one who is favored. This feeling affects the child's attitudes and behavior both in and out of the home.

Owing to differences in ability resulting from different levels of development, brothers and sisters are far less congenial playmates than are children from different homes. Usually a child will play happily with the outsider because he is of the same age and has similar abilities and interests.

Self-Concept, the Core of Personality

Personality is not a specific quality of a person but a quality of his *behavior* (*see* Personality). How he behaves depends upon how he feels about himself, about other people, and about his relationships with them. These feelings make up his "self-concept"—what he thinks about himself as a person. A person's self-concept is the fundamental core of his entire personality and determines the quality of his behavior.

A child is not born with a concept of himself. He builds it up gradually over the years as a result of his experiences. How he feels about himself and about other people depends largely upon how people treat him, at first in the home, and then outside the home as well. His self-concept depends also on how his abilities measure up with the abilities of the people with whom he associates and how these people feel about his abilities as compared with their own.

Unfortunately, self-concepts are not always realistic. Far too many children see themselves as they would like to be rather than as they really are. Usually the world does not treat a child according to his own fanciful concept of his personality. Then the child becomes disappointed, resentful, and antagonistic. His attitudes are reflected in his behavior, making his relationships with people even less favorable and leading to poor adjustments.

Once a personality pattern is established it is likely to persist. As the child's social horizons broaden, his self-concept will be modified and changed to some extent, but it will remain fundamentally the same throughout his life. Studies have shown that the adult personality pattern is formed early in life around the self-concept the child developed. Because early associations are limited mainly to the home, the family is primarily responsible for the child's personality pattern.

In the process of growing up, personality defects often develop. They are shown in unsocial behavior which makes people dislike the child, and this dislike in turn makes the child unhappy and discontented. The common personality weaknesses of children lead to the following forms of unsocial behavior: selfishness; self-centeredness; showing off; fear of people; self-fear; clowning; trying to escape from unpleasant or difficult situations by pretending to be ill; bullying and teasing; projecting the blame to others; feeling martyred and having easily hurt feelings; and feeling inferior as compared with others.

Most children show one or more of these weaknesses in personality pattern at some time. Spotting them in the beginning and helping the child to form a more wholesome self-concept is generally all that is needed to develop a happy, well-adjusted personality.

Influences That Shape a Child's Personality

There are certain influences in a child's life that play roles of great importance in shaping his personality. These influences are:

The family. The various members of a child's family may be admirable people, yet have poor relationships with the child. If the relationships are unwholesome—as when the child is overprotected or unloved—an imprint will be left upon the child's personality that time will never completely erase. If the relationships are wholesome, they will be an influence for good in his personality development.

The cultural pattern of the group. Every society has its own pattern of behavior for boys and girls. Within each society, also, the pattern varies somewhat for different social and economic groups. From earliest childhood, pressures from inside and outside the home are exerted to make the child conform to the group pattern. The more he conforms, the more people approve of him. For each sex there is a social ideal. A girl who would rather be a boy may try to follow the approved pattern for boys instead of the pattern for girls. Society expresses its disapproval of her behavior by labeling her a "tomboy." She soon discovers that boys do not like her, girls scorn her, and adults reprove her for her lack of "ladylike" ways. To win the approval of the group she must act like a girl whether she wants to or not.

The child's friends. After the child enters school he begins to spend most of his time outside the home with other children. He now tries to conform to the personality pattern admired by the group with which he identifies himself. He sees himself as his friends see him, even though this view is different from the concept his parents and other family members have of him. The self-concept he developed in his home during his early childhood days becomes strongly modified as he compares himself with other children in group popularity as well as in physical and mental abilities.

The school. Teachers and the general school environment exert more influence on the developing personalities of children than most people realize. A teacher who is critical, suspicious, intolerant, and rigid can play havoc with the personalities of her pupils. A better adjusted teacher, on the other hand, can do much to foster wholesome personalities.

The old-fashioned school insisted upon rigid conformity and disregarded the pupils' opinions. The modern democratic school expects the child to make the most of his abilities and respects his individuality. Such a school is far better for the development of a child's personality (*see* Education).

How to Train Children for Independent Living

THE AIM of child training is to produce mature adults who can live independent lives Independence comprises a number of qualities, each of which is desirable in itself For example, an independent adult is healthy, he is economically competent and he is emotionally adjusted The development of these desirable qualities cannot be left to chance

Too much help help of the wrong kind or at the wrong time, or help when it is not needed may be as bad or even worse than no help at all When a child s every act is guided he becomes dependent fearful, and resentful toward those who do not give him the freedom other children enjoy Too little guidance, on the other hand dooms a child to repeated failures that make him feel inadequate

LEARNING TAKES TIME AND PRACTICE

Self feeding is a big job for a little tot Show him how to do it and then let him practice in his own way and at his own speed

A cook is not made overnight Practicing this art as play will lay the foundation for an important skill in later life

Today s children should not be guided by the age-old principles in vogue when their grandparents were young To be successful in adult life, the American child must learn to be resourceful responsible self-reliant poised self-confident and even aggressive He will not learn these qualities in a home where Mother knows best and where Children should be seen but not heard '

Because children are fun parents are tempted to prolong each cute period of a child's life Parents can and do take pride in new teeth new words school skills social success and athletic achievements They should take pride also in the child s awkward attempts to think and act for himself Each new phase is a stage in the advance to maturity and brings new joys for both parents and child

When and How to Teach New Skills

Childhood is the ideal age to master skills The child has plenty of time to learn He is not bored as adults are by the constant repetition that learning demands His mind and body are still plastic so that learning is relatively easy for him And he has few already learned skills to interfere with the new ones he is trying to master

Modern life requires that the child learn many things The school cannot do all the teaching It is therefore the parents responsibility to teach him many skills before he goes to school and then to work hand in hand with the school in the difficult job of preparing the child for adult life

Here is a brief outline of the skills that American children of today are expected to acquire at different ages and levels of development

Up to two years Control over the entire body *Basic activities such as walking reaching and grasping* Improvement of these activities by faster movements and the elimination of waste motion

Two to six years Skills connected with *personal habits*, such as eating self feeding, dressing bathing, and toileting *Play skills* such as running, jumping, climbing throwing and catching a ball, tricycling, swimming skating jumping rope, dancing cutting, pasting crayoning painting and weaving *Household help skills* such as dusting setting and clearing the table, and emptying wastebaskets

Six to twelve years *School skills* such as writing, drawing, and playing a musical instrument *Play skills* of a more complex sort needed for ball games and all forms of outdoor play *Household help skills* that enable a child to care for himself and help others when the mother is ill or absent

How to teach The best single method of learning is through imitation Whether the child is learning

to dress or to feed himself, to cook, sew, speak, read, do arithmetic, or play ball games, the method he uses will be the method he has observed his parents, teachers, or friends use. The method must be one he can understand and follow. It should also be a method that will prove as useful to him, as time goes on, as it was when he first learned it.

Mistakes should be corrected early so that they will not become deeply rooted habits. "Practice makes perfect" only if the practice is in the right direction. Continuous practice in the wrong direction will establish a deep-rooted habit that may prove a great handicap to the child as he grows older. The major part of guidance should therefore be in the early stages of learning.

Learning is marked by ups and downs, periods of improvement, of standing still, even of going backward. If a child is to have the incentive to put forth the effort and spend the time needed to learn, he must be praised, encouraged, and occasionally rewarded for his efforts. He must also realize that what he is learning will be useful to him.

When to teach. The starting point of good guidance is a knowledge of the particular child, his abilities and weaknesses, his likes and dislikes. Children differ so greatly that it is impossible to lay down any hard-and-fast rules about when to teach any one of the thousand things a child must learn. One rule, however, must always be followed if good results are to be obtained. This rule is that *learning must wait upon maturation.*

Here are three simple rules for determining a child's readiness to learn:

1. Readiness is revealed by *interest* in learning. A baby will be interested in learning to feed or dress himself when he is able to do so. Similarly, an older child will show an interest in learning to read, skate, or make things with hammer and nails when he is physically and mentally capable of doing so.

2. Readiness is revealed by *persistent interest.* A passing interest may come entirely from the novelty of a situation. If the child is really ready to learn, his interest will persist in spite of difficulties the learning may entail.

3. Readiness is revealed by *improvement with practice.* The child who is not ready to learn will show little or no improvement with practice and will be so discouraged that he will not want to continue the learning.

To be ready to meet the demands of adult life, every child must learn gradually to stand on his own feet, make his own decisions, and accept responsibility for his decisions and acts. Too much independence, given too suddenly, will make a child fearful and will actually result in making him overdependent. Nothing is worse for a child than to be kept dependent on his parents during the preschool years and then to be sent off to school. A child subjected to such an ordeal is likely to become a major problem. His classmates ridicule his babyish ways. He becomes fearful, hates school, and tries in every possible way to avoid going.

READINESS TO LEARN

A child learns a lot from watching how things are done. Soon he will be ready to learn and will take over the job himself.

A child must first show his ability to handle independence successfully in small things. Each month he can be given slightly more independence than he had in the previous month. This may not seem like much to the child or to his parents, but, over a year's time, it is remarkable how much more independent the child will be. When he goes to school, he finds the adjustment relatively easy.

How to Avoid Emotional Outbursts

Far too many children are permitted to indulge in fits of temper when they are crossed, to avoid things they are afraid of, or to work out their jealousies on innocent victims. Such behavior patterns should be checked before they take too strong a hold on the child. Here are some of the best ways to deal with emotional outbursts:

1. Keep the home environment as free from emotional tension as possible. A child who sees his parents calm and unruffled is far less likely to be emotional than is the child who has a pattern of constant emotional tension before him.

2. Avoid fatigue. Children are much more given to emotional outbursts when they are tired.

3. Encourage the child to talk about the things that upset him. Talking releases pent-up emotional energy and also helps the child to gain a clearer understanding of the things that have upset him.

4. Put yourself in the child's place. Try to imagine how you would feel if the things you do to the child were done to you. Parents and teachers frequently do or say things, quite unwittingly, that upset children and lead to emotional tension.

5. Divert the child's attention, when you see an emotional storm brewing, to something that interests him. Later, analyze the cause of the trouble and avoid a repetition of it.

6. Be sure the child has plenty of exercise. Exercise is an outlet for emotional tension. When you see a child becoming tense, suggest some active play unless he is already fatigued.

A TEMPER OUTBURST

It s no fun to be behind bars when you want to explore the world If you get angry enough someone may let you out

7 Let the child do things at his own speed Children are slower and much less efficient than adults If you push them they become tense and irritable

Children Need a Feeling of Security

To be happy everyone needs a reasonable amount of security Material security is far less important than emotional security A child who knows he is loved and has people he can turn to in time of need is likely to grow up to be a well-adjusted successful adult no matter how poor his home and clothes and no matter how scanty his food The poor little rich child by contrast may have all the material possessions he could desire but lack what he needs most—love and interest from his parents

To develop feelings of security a child must realize that he has a place in the family that cannot be usurped by another child He must feel sure of his parents love even when they punish him He must have a room or at least a corner of his own no matter how small it is His possessions should be used by others only with his knowledge and consent There must be reasonable stability in the pattern of his family life When changes are unavoidable as in the case of death divorce or moving to another neighborhood or community the child should be made to feel that his status in the family and his parents love for him remain secure

IN TIME OF TROUBLE

No matter how independent a child is, he cannot face the world alone His mother should be close at hand when she is needed

When a child reaches the school years he still needs the reassurance of his parents love The warmth of family life is especially important at the end of the day if school or play has been particularly trying Ideally the mother should be at home when the child returns so that he can talk over with her any experiences that have pleased or disturbed him With his feeling of security restored he is ready to face the next day

How to Cultivate Self Confidence

Self confidence is not a hereditary trait It must be cultivated through years of experience and it is learned best if there is guidance

Lack of self confidence is not always shown in the same way One child may be shy fearful and unwilling to try anything new or different He conceals his abilities and lets opportunities pass him by Another child may strut and boast as if he had all the confidence in the world Such a child is likely to blunder into unfortunate situations where the really self-confident child would hesitate to involve himself and is crushed by failure

By contrast the child who has a healthy self-confidence will make the most of his abilities and opportunities He has a realistic idea of his weaknesses as well as of his strengths He accepts his failures and learns from them as well as from his successes

Here are some suggestions for developing real self confidence in children

1 Grade the things the child is expected to do according to his abilities You can tell by the child s actions whether the task is too easy too hard or right for him

2 When the child wants to do something you are sure he is incapable of doing suggest a substitute you know he can do successfully Do not discourage him by telling him he will fail in what he wants to do

3 Permit the child to have some failures but see that they are not too severe or too frequent Occasional failures will help to make him less cocksure and enable him to assess his abilities more realistically

4 Follow every failure with success whenever possible to avoid developing feelings of inadequacy

5 Help the child to form a realistic conception of his own abilities Children have had too little experience to know what their true abilities are

6 You yourself must have a realistic conception of what the child can do and accept his best

7 Never encourage the child to believe that he can do anything he wants to do if he is willing to try hard enough Nature places limits on what one can do even when one exerts one s self to his utmost

8. Praise the child for his efforts as well as for his achievements. Do not reserve your praise only for achievements that come up to your expectations.

Children Like Routine

A definite routine adds to a child's feeling of security. Unlike the adult, he is not bored and irritated by having to do things at a definite time and in a definite way. He likes to know what to do, when to do it, and how to do it. The child who has emotional difficulties is far more often one whose life is unregulated than one who has a sensible routine that fits his level of development.

The following principles must be adhered to in planning a routine for children:

1. The routine must be fitted to the child's level of development.
2. Adequate time must be allowed for each activity. Children do things more slowly than adults.
3. It is better to make several suggestions and let the child make the final choice. A child rebels when he thinks he is being forced to do something, even if he actually wants to do it.

Finally, it is a good policy to map out the day's schedule with the child when he is old enough to have some preferences. This can be done shortly after his third birthday. Each morning, let the family decide as a group what each child will do in the way of home responsibilities, play, and schoolwork. This discussion gives each child an opportunity to exercise some initiative and makes him realize that his own routine must be fitted into the group pattern.

There are certain routine activities that a child must learn to accept graciously because they contribute to the welfare of the group or to his own health. Meals must be eaten at regular times, even if they interfere with his play. He must go to bed at a time prescribed by his doctor. Home duties must be performed when they are needed, not at his convenience. His play and study must also be fitted into a time that will be convenient for all the family.

Most children are willing to accept routines if they see the reasons for them—and if allowances are occasionally made. For example, a child will rebel against his scheduled bedtime far less if, occasionally, he is permitted to stay up later than usual for something he is particularly eager to do.

How and When to Discipline

Discipline means *training to conform.* It is not the same as punishment. Its purpose is to train the child to do the things that society believes are right. The child must learn that rules and regulations are not senseless restrictions but are necessary to enable people to live together happily and harmoniously.

Many children break rules not because they are trying to make life difficult for their parents and teachers but because they really do not know that what they are doing is wrong. Explain each rule carefully to the child in words he can understand and emphasize the relationship of the rule to all types of similar situations. Ask the child to tell you in his own words what the rule means to him and set him straight if he has twisted its meaning. A child's memory is short. He must usually be told time and again what he is to do or not to do.

ONE OF CHILDHOOD'S HEARTACHES

When a child is kept out of things, it makes him even more unhappy to see others having fun. He wants to belong to the group.

Praise. Praise should play a major role in discipline. It is a powerful stimulant and gives the child the necessary motivation to try to do what is expected of him. A child deserves special praise when he tries hard or makes personal sacrifices even though the results are not up to expectations. A smile, a pat on the back, or a few words of commendation are all he needs to drive him on to renewed exertion. Contrary to popular opinion, praise does not make a child lazy or self-satisfied. Instead, it makes him eager to do what is expected of him. One cannot praise a child too much for real accomplishment.

Bribes. A bribe is an offer of a reward given before the act is completed. A child who is bribed will do what is asked of him only so long as the bait is held before him. When the bribe is not offered, he will do as he pleases. Bribes should have no part in discipline.

Rewards. Occasional rewards, like praise, are important in discipline. They should not be promised ahead of time but given as a surprise after the act is completed. The best time to give them is when it is apparent that the child has been trying very hard, not just when the results are good. Any simple treat, a small gift, or special recognition such as praising him in front of others or putting his name on an honor role will give him an incentive to forge ahead.

Punishment. Only when it is obvious that a child has intentionally disobeyed a rule should he be punished. If discipline has been of the type outlined above, few occasions will arise when punishment will be needed. When they do arise, the type of punishment should be carefully considered, not given in a fit of anger. Slappings and spankings are likely to make the child so antagonistic that he will cease trying.

Expecting a child to make amends for his misdeed makes sense to him as a punishment. If he has to mop

A MEMBER OF THE FAMILY TEAM

He ping at home gives a child a feeling of self importance and of belong ng It can be fun as well as good training for the future

up milk he intentionally throws on the floor say he is sorry when he does something he knows he should not do or replace with something of his own the possession of another that he breaks in a fit of temper he will think twice before repeating these acts

Sending a child to bed or depriving him of a meal because he was naughty has no educational value whatever The child is likely to build up a dislike for bed and rebel against going there When deprived of a meal he is likely to get hold of food anyway but of the wrong kind With older children it is sometimes a good policy to deprive them of some pleasure such as going to a movie or watching television when they have been intentionally troublesome It also helps to send them to their rooms explaining that they must stay there so long as they persist in making life difficult for other people

Traits That Make for Popularity

Being popular with his friends goes a long way toward giving a child the self-confidence he needs to make the most of his abilities Real security is achieved only when the child feels that he is accepted wherever he is—in the home in the school or on the playground

Scientific studies show that there are certain traits that lead to popularity at every age These traits are co-operativeness good sportsmanship cheerfulness a sense of responsibility to the group a sense of humor willingness to look at things objectively and not to have one s feelings hurt when no offense is intended unselfishness maturity of behavior (for the particular age level) reasonably good manners outgoing temperament willingness to offer suggestions for group activities skills that enable one to keep pace with others and the desire to give others a good time A child with most or all of these qual ties will never find himself without friends These qualit es should be cultivated as early as possible

A child should have permission to do what others do when they do it and access bility to others so they can be with him when they wish He will have more chance of being popular if he belongs to a group with s milar backgrounds abilit es and interests Children are likely to choose as friends those who are kind to them regardless of whether they have anything in common The child needs guidance to learn to choose suitable companions This of course does not mean that he should be encouraged to be snobbish or to discriminate against other children because of their race creed or color It means that a child frequently needs guidance in determining whether or not the child he likes has the qualities that will make for congeniality

The child needs guidance also in learning to keep the friends he has made Letting children fight it out results in hurt feelings and even physical injuries In the early years the parents should be close at hand when ch ldren are playing and be ready to arbitrate should a quarrel start Gradually the child will learn from exper ence how to handle his disagreements without adult help

Early Training for Good Citizenship

The good citizen has a sense of responsibil ty to his group He tries to add to the enjoyment of others He recognizes the rights of others realiz ng that the world was not made for him alone He is even willing to do things he does not want to do to help others Even a very young child can learn to do something for the people with whom he lives and to behave in a manner that will not inconvenience or hurt them

Shortly after the child begins to walk he can learn to carry his share of the burden at home without grumbling He may not be able to do much for other people but he can help them ind rectly by do ng as much as possible for himself and by not demanding too much attention Each year he can take on more and more responsibility doing things for people in the neighborhood as well as at home and at school Such training will prepare him for the role of a good citizen when he reaches maturity (See Citizenship)

Guiding the Child s Recreation

Left to their own devices most children will spend their free time on recreations that require a minimum of effort They will watch television listen to the radio look at comics and go to the movies These recreations are part of the pattern of American life today To enjoy them fully and to derive benefit from them the child needs guidance

There are excellent programs of mus c good plays interesting news and information about cultural subjects as well as healthy humor The programs, however must be carefully selected and the time spent on them should be l mited

Healthy recreation includes solitary play at home as well as games and sports outdoors with other children A child should never become totally dependent upon others for enjoyment or so self-suffic ent that he shuns companionship A happy balance of solitary and group play should be encouraged (see Play)

Creative activit es of all sorts music painting and crafts—should have an important place in the child s recreation Such activit es amuse the child

release tension and give him a sense of achievement that increases his self-confidence. Furthermore, they form the basis for adult recreation and hobbies and help the individual to appreciate the achievements of others (*see* Hobbies; Painting).

Boys and Girls Have Different Roles

Every society has clearly defined roles for members of the two sexes. Girls are expected to behave like girls and boys like boys. Because boys enjoy a superior position in our society, many girls wish they were boys and some try to act like boys in the hope of gaining the privileges that boys enjoy. Few boys wish they were girls. Instead, they feel superior and often treat girls with the contempt that accompanies feelings of superiority.

From earliest childhood, girls should be encouraged to act like girls and to recognize that the feminine role is not inferior to the masculine. Similarly, boys should be encouraged to be boys; but they should learn that treating girls as inferiors by teasing, bullying, or criticizing them is poor sportsmanship. The battle between the sexes, so common in childhood, may continue into adult life unless both boys and girls learn when they are young to have a healthy attitude toward their own sex and toward members of the opposite sex.

How Parents Can Co-operate with Teachers

Education is essential for success in modern life. Parents can help the child to develop a favorable attitude toward studying so that he will not end his studies at the end of the school day or when he receives his diploma at graduation. Here are some of the ways parents can co-operate with teachers to help the child do the best work he is capable of doing:

1. Give meaning to the child's lessons by relating what he is learning in school to his other activities. His study of history and geography can be associated with movies and with television and radio programs.
2. Encourage the child to read as much as possible. Practice in reading increases speed and comprehension. Reading also widens interests and enables him to learn many things he can find out in no other way.
3. Build good study habits by showing the child how to use his study time to the greatest advantage. Keep the house quiet when the child is studying.
4. Supplement the teacher's work, when necessary, by explaining anything the child did not understand in his class work. Many children are too timid to ask a teacher to repeat or clarify what she has said.
5. Help the child to form friendships among his classmates. He will be happier and will do better work if he has friends in school.
6. Encourage the child to take an active part in the school's extracurricular activities. School will be a pleasant experience for him if he feels that he is a part of it.
7. Help the child to develop good relationships with his teachers. When teacher-pupil friction arises, talk over the problem with the child and help him to see that the source of the friction is not necessarily all on one side. Then show him how he can get along better with his teacher. Good teacher-pupil relationships are essential to good schoolwork and to good social adjustments with classmates.

BEING A PAL WITH DAD

The older child wants his parents to show their love by being pals and enjoying the things he himself is capable of doing.

Children Want and Need Affection

The child who is loved and wanted at home will make good adjustments outside the home. Such a child is far better prepared to face the problems of adult life than is the child whose outlook on life has been warped by feelings of resentment against his family.

All children want to be loved. The expression of parents' love, however, must be adjusted to the level of the child's development. A baby likes to be fondled. Before his toddler days are over, hugging and kissing embarrass him, especially before other children. By the time he is in school, he will rebuff such expressions of affection, but he still wants to be loved.

The older child wants to be loved in a different way. He wants his parents to be interested in the things that interest him and to treat him as a pal by doing things with him. Listen attentively when he tells you of his joys and sorrows. Do things with him that he thinks are fun. Constant criticism, punishments that the child feels are undeserved, or lack of interest in the things that are vitally important to him are interpreted by a child to mean that his parents do not care for him. The child responds by behaving in a manner that makes it difficult for anyone to love him. When a child is most troublesome, that is the time when he needs the most love.

CHILD LABOR LAWS In the early part of the *19th century many children in England and the* United States worked 12 or 14 or even 16 hours a day in factories mills and mines They began to work as young as 5 or 6 The long hours of hard labor ruined their health and the dangerous machines crippled many Children had worked in homes and fields from the earliest times Child labor did not become a serious problem however until machine production got under way in the 19th century A ready source of cheap labor children were then poured into the factories (*see* Industrial Revolution)

When people came to realize the tragedy of these children s lives a fight began for laws to protect boys and girls from ruthless exploitation In England Parliament had prohibited the African slave trade but as the poet Robert Southey wrote The slave-trade was mercy compared with the child trade in factories Elizabeth Barrett Browning described *these babies grown old beyond their years in her* poem 'The Cry of the Children Men like Sir Robert Peel (father of the well known statesman) Richard Oastler John Fielden and Lord Shaftesbury labored *unstintingly to lighten the slavery of children to* machines It was a long fight Gradually however improvements came about and Britain began to make laws regulating the employment of children

European Regulations

The first child labor law was passed in Britain in 1802 It limited children s work to 12 hours a day and forbade night work The next act in 1819 forbade employment in cotton mills of children under nine Neither act was adequately enforced The first effective act passed in 1833 provided for state inspection and applied to both woolen and cotton mills It limited the work of persons between 12 and 18 to 12 hours a day The greatest advance came in 1847 when working hours of persons under 18 were limited to 10 hours a day The British government now gives the matter of child labor careful attention Since *1947* the school leaving age has been 15 The law prohibits the employment of school children in industry before they are 13 and *limits it after that age* The Children s Act of 1947 dealt with the whole question of child labor in a thorough and *enlightened manner*

Other industrial nations followed Britain s lead The reform movement was *quickened after 1919 by* the work of the International Labor Organization (now an agency of the United Nations) This organization seeks to improve labor standards through international action

United States Measures

In the United States also child labor steadily increased after the introduction of machine methods In 1910 one child in every six between the ages of 10 and 15 was employed in industry or in agriculture After 1910 child labor began to decrease chiefly because of legislation and aroused public opinion

In 1916 and in 1919 Congress passed national child labor laws but the Supreme Court declared them unconstitutional In 1924 a constitutional amendment was proposed to give Congress power to regulate the *employment of children* under 18 *years of age* It was not ratified In 1938 Congress passed the Fair Labor Standards Act One of its provisions forbade interstate shipment of products made by any enterprise which employed children under 16 years or under 18 years in hazardous enterprises such as mining The law was modified in 1949 to permit employers to hire children under 16 for certain hours in offices or in selling The secretary of labor administers the law

State legislation has been hindered by the reluctance of states to put their employers at a disadvantage in competing with employers in other states Most states however now have a 14 year or a 16 year age minimum for children in industry limit their labor to 48 hours a week and prohibit their employ*ment in dangerous or unhealthful occupations*

The Rich DESERTS *and Fertile* FARMS *of* CHILE

Extent —North to south nearly 2 700 miles east to west maximum 221 miles minimum 31 miles Area 286 396 square miles

Population —(1952 census) 5 930 809 approximately 70 per cent live in the Central Valley

Highlands Lowlands and Waterways —Andes Mountains forming eastern boundary and increasing in height from 6 000 or 7 000 feet in the south to more than 20 000 feet in center greatest height Aconcagua on Argentine border 22 835 feet) Coast Ranges on west long Central Valley 300 to 1 000 feet above sea level desert nitrate plain in north rivers few and short mountain lakes especially in south

Exports —Copper nitrate and iodine iron ore steel coal gold silver sulfur, salt wool and sheep skins meats beans peas lentils oats barley fruits wine

Other Products —Wheat potatoes corn rice tobacco lumber

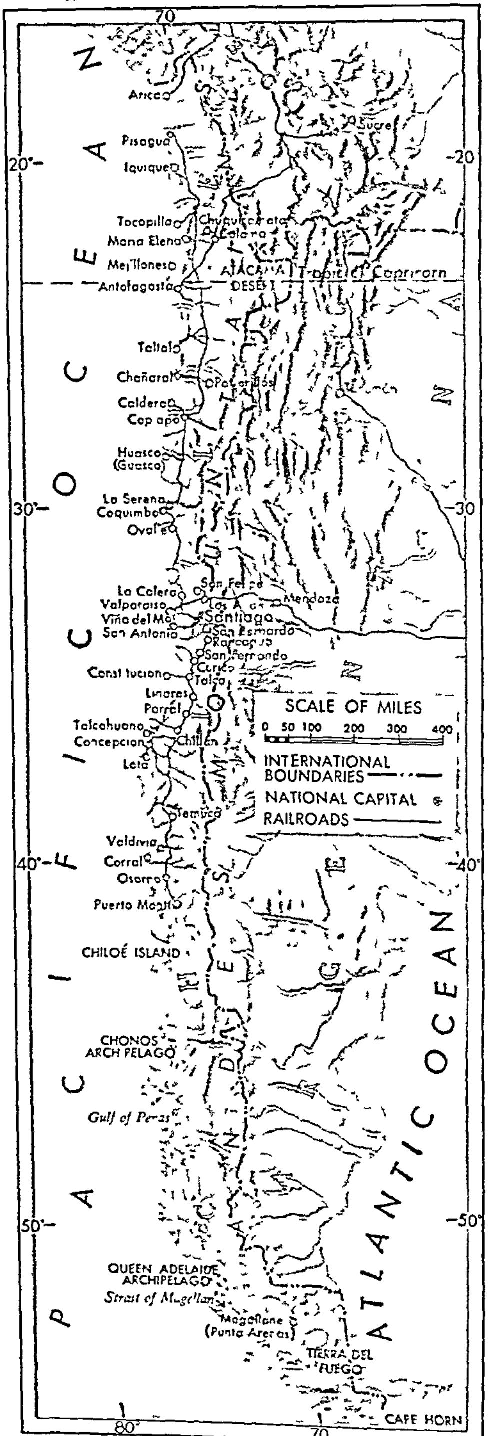
Imports —Machinery and vehicles iron and steel products textiles and yarns petroleum and petroleum products sugar chemicals paints and varnishes foodstuffs

Chief Cities —Santiago (capital 1,348,283 Valparaiso (218 829) Concepcion (119 887) Viña del Mar Antofagasta Talca Talcahuano Chillán Temuco (over 50 000 Valdivia Iquique La Serena Punta Arenas Puerto Montt (over 25 000)

CHILE (*chĭl ē*). Its extraordinary shape and its wide variety of *scenery climate and re*sources make Chile one of the most remarkable countries of South America On the map it appears as a long narrow strip of mountainous land edging the Pacific for more than *half* the length of the continent It is so long that its head is burning with tropical sun while its feet are freezing Its mountains rise to towering heights —the highest peaks in the Andes Chile has some of the most magnificent mountain scenery in the Cordilleras It has one of the most desolate desert regions in South America and it has a beautiful and fertile valley where almost any plant of the middle latitudes will flourish

In the north is a great expanse of rainless desert where not a blade of grass will grow Yet the valuable nitrate deposits of this parched land have nourished the crops of two hemispheres and have brought Chile wealth and an important place in world commerce In the south on the other hand is a cold water-soaked area of heavy forests and grazing land where rain or snow falls almost incessantly during much of the year Here is the southernmost city on

A LONG AND NARROW LAND



Notice how Chile is squeezed in between the high ridges of the Andes and the Pacific Ocean. For most of its great length it has Argentina for a neighbor.

the globe; and here, at the continent's end, lives one of the most primitive of peoples. Between these two inhospitable regions lies the fertile and beautiful Vale of Chile where a delightful climate, much like that of California, prevails the year round. This is the heart of the nation, its granary, and its center of population and culture.

The Varied Face of the Land

The republic extends from Cape Horn at the southern tip of South America to about 18° south latitude, well within the tropics—a distance of nearly 2,700 miles. If it were placed on the North American continent, it would reach from Florida's southernmost point to northern Quebec in Canada. In width it varies from 31 to 221 miles. With an area of 286,396 square miles, it is somewhat larger than Texas

About 70 per cent of the land is mountainous. Throughout its length the Andes rise in a great massive wall, which tapers off gradually until the mountains dip into the sea at the end of the continent. Their western slopes belong to Chile, their eastern slopes to Argentina. From heights of 6,000 to 7,000 feet in the south the ranges become increasingly higher through central and northern Chile, where a number of peaks more than 20,000 feet high raise their heads. On the Chile-Argentina border is volcanic Aconcagua, crown of the Andes (*see* Aconcagua). There are many volcanic cones in these ranges, but most of them, like Aconcagua, are extinct. Settling of the mountains causes frequent earthquakes. In 1939 one of the most destructive quakes ever recorded shook the country from Iquique to Puerto Montt It took tens of thousands of lives, destroyed Chillán, and badly damaged other cities.

With the great Andean barrier as its backbone, Chile faces the sea. (*See* Andes Mountains). Along the Pacific, the much lower Coastal Ranges rise abruptly from the ocean, which reaches great depths off the coast. From about 30° to 43° south latitude these mountains parallel the Andes, enclosing the Central Valley, or Vale of Chile. Crossed by low transverse ridges of hills, the valley runs south for about 700 miles, sinking into the sea in the neighborhood of Puerto Montt. There the coastal mountains break into fragments, forming a long chain of islands which fringe the coast for hundreds of miles. Far to the south is the large island group called Tierra del Fuego. Between the Chilean Archipelago and the Andes, the coast is frayed by many sounds and fiords. High winds blow around it and the swirling waters have tossed many a ship on the rocky shores. North of this island-strewn region, the whole coast line of Chile is remarkably regular, with no safe natural harbors. There are more than 50 ports, but at most of them large ships usually anchor well out at sea and use lighters and launches for loading and unloading both passengers and freight.

Geographically and economically the country falls into the three major regions suggested above—the mineral-producing northern desert; central Chile, containing the Central Valley, where most of the nation's food is grown; and the wet, island-strewn, sparsely settled southern third, where sheep grazing is practically the only industry.

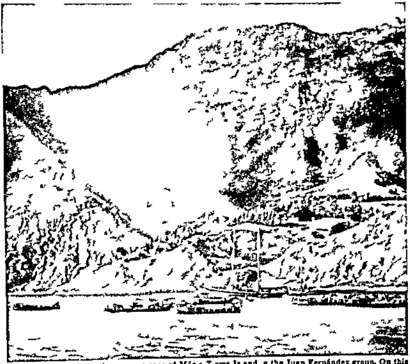
Variety of Its Climates

Because of its great length and its high mountains, Chile has many different types of climate. Another major influence is the Humboldt Current from the Antarctic, which is

carried northward from 40° south latitude to the Equator by the trade winds Its cold waters and the still colder waters closer to shore give the coastal region remarkably low temperatures They are also partly responsible for the lack of rain in the northern desert The prevailing winds of this region are chilled by the water and then heated when they blow over the land The heat enables them to hold all their moisture and hence no rain falls The high Andes entirely shut out the winds of the interior and the trade winds from the Atlantic

The stimulating climate of central Chile helped to produce a vigorous warlike people quite unlike the Indians in tropical parts of the continent who were easily subdued and enslaved by the Spaniards The Chileans today many of whom have the blood of these early Araucanian Indians in their veins are an energetic and progressive people The Mediterranean climate of the valley suitable for varied crops and comfortable for living is the type that has produced advanced peoples the world over

MOUNTAINOUS ISLAND HOME OF ROBINSON CRUSOE



From the Pacific rise the gaunt slopes of Más a Tierra Island in the Juan Fernández group. On this isle which belongs to Chile Alexander Selkirk Robinson Crusoe spent over four years

The Desert and Its Mineral Wealth

In the Chilean desert which covers 40 per cent of the country s area the landscape is brown and barren The hot bright sun shines day after day upon glittering sand and bare rock In most of it years may go by without a single shower and great clouds of dust rise from the land Nowhere in the region is there more than ten inches of rain a year One may travel for miles and miles and see no plant life whatever—not even a cactus Yet this drab country is the nation s greatest source of wealth The part called the Atacama desert contains the only large nitrate deposits and the largest reserves of copper ore in the world Copper and nitrate or Chile saltpeter are the country s most valuable exports The Chileans therefore owe much to their arid desert for it preserves the nitrate which rain would dissolve and carry away

The Nitrate Industry

Sodium nitrate is a colorless salt which is used chiefly as a fertilizer to supply nitrogen to the soil For half a century the nitrate trade with Europe and the United States made Chile one of the most prosperous nations in South America The industry was developed chiefly by foreign capital and a heavy export tax furnished a large part of the nation s revenues Chile s best customers however learned to make synthetic nitrogen (*see* Nitrogen) and after the first World War the nitrate exports fell off rapidly In 1933 nitrate production was made a state monopoly the export tax was removed and costs of production were cut to help the industry to recover

The nitrate zone is a much interrupted strip about 450 miles long extending from 19° to 27° S The deposits that are worked lie in the pampa between the Coast Ranges and the Andes at heights from 4 000 to 7 500 feet The nitrate is a cementing material in the rock Ages ago percolating water carried it down from the mountains into the valley where it crystallized The nitrate-bearing layers of rock are called *caliche* They vary in depth from a few inches to many feet The caliche is broken up by blasting and is taken to *oficinas* (factories) where the nitrate is extracted and refined and iodine is produced as a by product Chile supplies most of the world s iodine (*see* Iodine)

The workers in the nitrate region are chiefly *mestizos* (people of mixed Indian and white blood) called *rotos* (ragged ones) Most of the oficinas are surrounded by workmen s houses and some of the larger

properties have stores, churches, theaters, and other community establishments. Foodstuffs, in general, are shipped in from other regions, since only in a few oases and small irrigated districts is there any agriculture. Water is piped in from melting snow fields high in the Andes.

Other products of the desert's dried-up lake beds are salt and borax. The borax "lake" is one of the largest in the world, and small quantities of the product are exported (*see* Borax).

Copper and Other Minerals of the Desert

The largest copper deposit in the world and the most extensive mining and smelting operations in South America are at Chuquicamata, on a mountain about a hundred miles inland There in the heart of the desert a United States company employs several thousand people to work the ore. The camp has the conveniences of the average North American city, with a theater, schools, hotels, athletic fields, and a health staff. There are other large copper works in central Chile. Copper and nitrate make up about three fourths of the total value of exports.

Rich iron-ore deposits are near La Serena and Huasco. Chile leads the continent in iron mining. Much of the ore is shipped to the United States. Aided by the Export-Import Bank, Chile opened its first steel mill in 1950 near Concepción. It fortified its own poor coking coal with imports from the United States. Chile also mines gold and high-grade sulphur. Silver mining, once important, has dwindled.

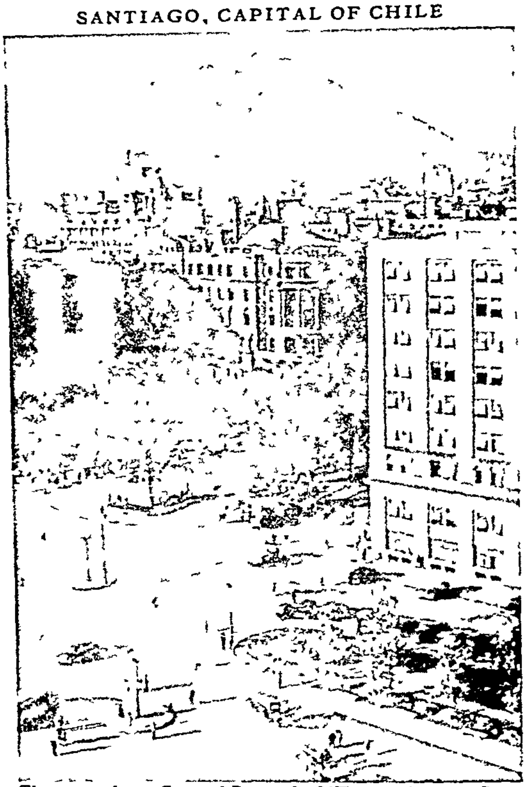
Agriculture in the Desert

Crops are grown on narrow ribbons of land that can be irrigated from the few small streams. Most of them are on the southern border of the desert. Beef or dairy cattle are raised on many farms, and alfalfa for feed is an important crop. Wheat, corn, barley, and a variety of fruits and vegetables are grown. This region, with its almost constant sunshine, is well suited for fruit drying and dried fruits are shipped along the coast. The small farms produce foods for the mining communities. Above 8,000 feet in the Andes a growth of short grass provides pasturage for sheep, goats, llamas, and alpacas.

Central Chile, Heart of the Nation

Central Chile has nine tenths of the people. Notice that the map has many towns from La Serena on the edge of the desert almost to Puerto Montt, some 900 miles south, and particularly in the Central Valley. In the Vale is centered the cultural, political, financial, and social life of Chile, and there is situated Santiago, its capital and chief city. There too and along the adjacent coast is grown most of the nation's food.

SANTIAGO, CAPITAL OF CHILE



This view shows General Bernardo O'Higgins Avenue. Santiago lies on a plain San Cristobal hill, in the rear, towers over the city. The Andes rise in the background.

The long Central Valley is filled with rich alluvial soils deposited by the Andes streams. It is level except where cross ridges connect the Andes and the Coast Ranges. Here and there, streams fed by melting snows in the Andes cut their way across it to the sea. The climate is delightful. In the northern two thirds of the valley it resembles closely the climate of the Mediterranean lands, with the temperature rarely falling below freezing or rising above 77° F. Most precipitation occurs in winter (May to August). The summers are long and rainless and the land must be irrigated for crop growing. The rainfall is explained by the prevailing winds. In summer the dry trade winds that cause desert conditions farther north influence the climate. But in winter the westerlies that make southern Chile one of the rainiest regions in the world blow farther north, bringing abundant rains to the central region. The coast, however, has summer showers, and in the southern part of the valley summer rains are frequent. In these regions there is less need for irrigation.

South of the Bío-Bío River (about 36° S.), the valley is similar to the Puget Sound-Willamette Valley of Oregon and Washington. There, in the dense forests, the Araucanian Indians defied successfully the might of the Spanish conquerors for 300 years. The area was later opened up, and Chileans and European immigrants, principally Germans, settled there. About half the land is covered with forests and there are luxuriant pastures. Here and there one sees a large lumber mill and crews of woodcutters. Crops such as barley, oats, and apples are grown without irrigation.

Less than 10 per cent of the area of Chile is suitable for crops. About 90 per cent of the cultivated land lies in the Central Valley. Yet only about 12 per cent of the valley is planted to crops. Three million or more acres have been irrigated by landowners, who are extending irrigation in coöperation with the

government Much of the valley is dry pasture un suitable for irrigation and is used for stock raising

Wheat is the leading crop of central Chile and al falfa is widely grown for stock feed Large areas are devoted to vineyards and quant ties of wine are mar keted Other crops are barley oats corn beans peas and legumes olives figs citrus fruits berries peach es and other fruits tobacco potatoes and garden truck

Most of the land is in large holdings More than half of it it is said is in some five hundred of these large estates called *haciendas* or *fundos* The wealthy owners or *patrons* usually live in the cities most of the year leaving *administradors to manage their land and* poorly paid *inquilinos* (ten ants) and rotos to grow the crops Life on the haciendas is not unlike life on the great feudal estates of medieval Europe Usually there is a strong attachment between patron and tenant

ONE OF THE WORLD S GREAT COPPER MINES

This is the great open p t copper digg ng at Chuquicamata in northern Chile Like many other Chilean coppe mines it is owned and operated by a United States company

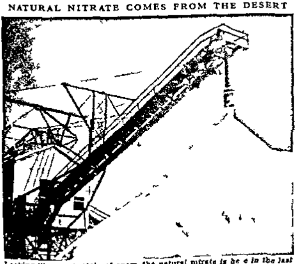
Mining and Manufacturing in the Central Valley

Although agriculture is by far the largest industry in the valley there is some mining Copper is the ch ef product but coal mining is increasing Central Chile has the largest coal depos ts on the cont nent Chilean coal is poor for coking but is mixed with imported coking coal Short swift rivers provide considerable hydroelectric power for industry

The principal manufacturing centers of the country are Santiago Valparaiso Concepc ón and Valdivia

A major objective of the government since the 1920 s has been to encourage manufacturing and Chile is becoming self-sufficient in a number of products that can be made from domestic raw materials Foodstuffs wool and cotton textiles leather shoes chemicals furniture and other wood products and tobacco goods are among the commodities produced in its factories. The number of skilled workers is steadily increasing

NATURAL NITRATE COMES FROM THE DESERT



Looking like a mountain of snow the natural nitrate is he e in the last step of ts refining p ocess In the practically rainless desert st etches the nitrate-bearing rock or *caliche* is found From the rock and dirt is separated the product which you see here.

Southern Chile

Gray skies heavy rains cold winds and dark tan gled forests make southern Chile as uninviting as the northern desert Lying in the roaring forties it is one of the stormiest regions on earth The strong variable westerly winds bring excessive rainfall (200 inches in places) as they rise to cross the Andes The snow line diminishes from about 5 000 feet to less than 2 500 Rugged land broken along the coast into thousands of islands glistening mountain lakes and glacier fed streams and the heavy blanket of forest give the country a wild appearance

South of latitude 50° however and parti cularly in northwestern Tierra del Fuego the rugged land gives way to broad wet plains In this region sheep raising the chief industry of southern Chile is carried on Grasses are green the year round and in the cold climate the sheep grow long thick fleeces of high quality

The *estancias* (ranches) are very large some of them more than two million acres in area with 20 000 or more sheep Many are British owned The herders chiefly Scottish Welsh and Irish assisted only by their sheep dogs tend the flocks in their migrations over the vast pasture lands Three-quarters of Chile s sheep are raised in this region They furnish a like proportion of the country s export of wool There are a number of freezing plants Mutton sheepskins and sausage casings are also exported

South of Puerto Montt there is little farm ing Lumbering in the conifer and hardwood forests has developed slowly Most of the timber

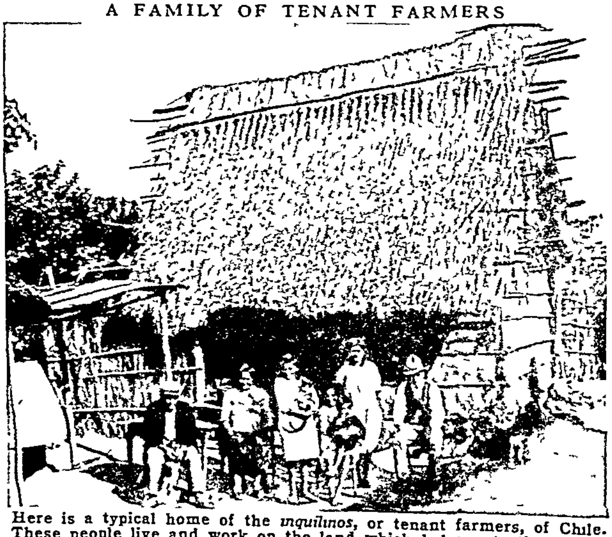
is suitable only for posts, poles, and second-rate lumber. The constant rains, and transportation difficulties over the wet, spongy ground, seriously handicap the industry. There are, however, sawmills near the coast. Lumber is exported to neighboring nations and cabinet woods and *quillay* bark (soap bark) are shipped to Europe and the United States.

In most of southern Chile the population density is less than one person to the square mile. A few remnants of early fishing and hunting Indian tribes live there in most primitive fashion. The few Yaghans, in southern Tierra del Fuego, are the southernmost people in the world. They have no weapons, almost no clothing, and live on fish. Their homes are canoes or brush shelters. Hunting tribes of Chiloé Island and the mainland near by have mingled with immigrants and are good lumbermen and foresters.

Transportation and Trade

A map of Chile's transportation systems looks like a very tall ladder. The Longitudinal Railway in the interior—running from Pisagua to Puerto Montt—and the shipping lane along the coast form the uprights. The short rail and highway routes connecting the numerous ports with the Longitudinal line and the producing centers in the interior form the rungs.

A FAMILY OF TENANT FARMERS



Here is a typical home of the *inquilinos*, or tenant farmers, of Chile. These people live and work on the land which belongs to the *patron*, or landlord. They are a part of a feudal system which still survives.

Chile has about 6,600 miles of railways, some electrified. The government owns about half the total mileage. Two lines cross the Andes to Bolivia, giving it access to the Chilean ports of Arica and Antofagasta. A third, linking the Pacific and Atlantic oceans, is the Transandine railway. It runs from Valparaiso to Buenos Aires, climbing nearly 10,500 feet to tunnel through the Andes. Landslides often block the road. A fourth, opened in 1948, crosses the Andes from Antofagasta to Salta, Argentina.

The sea was the earliest and is still the most serviceable highway. There is coastwise traffic between different sections of the country and some 30 ports are visited by ships engaged in international trade Chile's merchant marine is one of the largest in South America. The building of the Panama Canal brought the nation closer to world markets and greatly stimulated its industrial development.

Of some 31,500 miles of roads about two thirds are all-weather roads. The best highways, some of them concrete, are in the Central Valley. In rugged regions where there are only trails, goods are carried by pack animals.

Air service, under government ownership, links the chief cities. There are no railroads south of Puerto Montt, but southern Chile is served by air. Foreign companies supply regular service to other Latin American countries and to the United States and Europe.

In the total value of its foreign trade Chile is one of the leading nations of Latin America. In general it ships raw materials and receives manufactured goods in return. Nearly four-fifths of the value of all exports comes from its minerals—copper, nitrate and iodine, iron ore, gold, silver, sulphur, and sulphate of soda. The sheep-raising industry is the source of the second group in value—wool and sheepskins and fresh and frozen meats. Lentils, beans, peas, oats, barley, fruits, wine, and wood products are also exported, chiefly to neighboring countries.

The major imports are machinery, transportation equipment, iron and steel manufactures chemicals, petroleum and its products, textiles sugar, and other foodstuffs. Chile's dependence on imported petroleum lessened when oil was discovered on Tierra del Fuego in 1945. A pipe line for crude petroleum was opened in 1950 A large part of Chile's trade is with the United States and the United Kingdom and with other South American countries.

Cities and Resorts

Nineteen of the 26 cities with a population of more than 10,000 are situated in central Chile. Beautiful Santiago, the capital, lies in the northern part of the Central Valley. It is connected by rail and highway with the port of Valparaiso, 117 miles northwest. Viña del Mar, near Valparaiso, is the leading sea resort on the west coast. (*See* Santiago; Valparaiso)

Near the mouth of the Bío-Bío River is Concepción, the third city in size and the central gateway to the valley. It is a commercial center for a rich farming hinterland and a favorite tourist resort. Concepción is served by the port of Talcahuano, a government naval station which has one of the best natural harbors on the coast.

At the southern end of the Central Valley are Osorno and Puerto Montt, smaller commercial cities Both are in a region of charming scenery. The volcano of Osorno, probably the most beautiful in Chile, resembles strikingly Japan's famous Fujiyama.

Antofagasta, Arica, Iquique, and lesser ports handle the trade of the northern desert region. Magallanes

(Punta Arenas), the southernmost city in the world, is a free port and the trade center for the sheep industry Before the opening of the Panama Canal it was important as a coaling station In December and January it has 17 hours of daylight

A CHILEAN "HUASO"

A striking figure in his holiday costume is this *huaso* who is the "cowboy" of his country

Two island possessions far out in the Pacific are of exceptional interest The origin of the colossal stone statues on Easter Island is one of the unsolved mysteries of the world (*see* Easter Island) On the largest of the Juan Fernandez group Alexander Selkirk a British sailor lived for four years His adventures there inspired Daniel Defoe to write his Robinson Crusoe more than two centuries ago (*see* Crusoe Robinson)

Recreation Sports Games

Scenic beauty, mineral springs splendid beaches and opportunities for summer and winter sports attract numbers of foreigners as well as Chileans to the many pleasure resorts There are fine race tracks and golf courses and excellent fishing Skiing skating and tobogganing are becoming increasingly popular The ski fields near Chillán and near Santiago are among the best in the world

The Chileans hardy and vigorous are fond of strenuous sports Soccer is the most popular game and polo is a favorite with the wealthy Polo teams have demonstrated their prowess at numerous international meets Boxing golf, tennis and bicycling also are popular Rugby football and croquet are played mainly by the English The Indians are adept at *chueca*, a sort of hockey played with a stone

The People of Today and Yesterday

More than half of the people are mestizos of Indian and Spanish blood From 30 to 40 per cent are of pure European descent, chiefly Spanish There are about 100,000 Indians today, most of whom are Araucanians, and a like number of foreigners—Germans Spanish French Swiss and others Immigration has been slow, chiefly because the only attractive region for settlement is in central Chile where most of the arable land is in the large estates

In general the people fall into two clear-cut groups those who own land and those who do not The few rich landowners live in splendor on their haciendas or in their city residences From this group come the statesmen, professional men, and the clergy The landless group is made up in large part of the poorly paid inquilinos on the great estates and the rotos, or laborers on the farms in the mines and in other industries They live in thatched huts and other humble types of dwellings The majority are agricultural workers To them it means little whether the great mining industries that support the government prosper or decline

The strong warlike Araucanian Indians lived in the forests of central Chile before the coming of the Incas in the 15th century and the Spaniards in the century following (*see* Incas) They successfully resisted these invaders for hundreds of years But they were forced south of the Bío-Bío River and in 1818 when Chile became independent they were given the right to the region called the Frontera In 1881 they were finally forced to recognize the authority of Chile and the Frontera was opened to settlement

Today as in the past, the Araucanians live chiefly by hunting and fishing Their dwellings called *rucas*, are never grouped in villages They make silver hair ornaments huge-headed pins for fastening shawls and the silver necklaces and ornaments which are a distinctive part of the Araucanian woman s costume Their textiles in beautifully blended colors have designs borrowed from the Incas, with squares and stepped and zigzagged lines predominating Rugs and pottery complete the list of their handicrafts

Their musical folklore is extraordinarily rich The Araucanian has a song for every act of his life There are songs for children, and choruses and ritual songs

GRAPES FOR THE WINE OF CHILE

The abundant grape crop is picked by itinerant laborers called *rotos* meaning the "ragged ones" These are roto children. The vineyards are mostly in the Central Valley

which are used in religious and social ceremonies. Their music has remarkable rhythm and melody.

The Arts and Education

The Araucanian influence is strong in Chile's music and literature. "Araucanian rhapsodies" and "Araucanian poems" abound in the work of the composers. Many writers have made valuable contributions to the nation's literature, and its painters and sculptors are widely known through their exhibits at international exhibitions. The arts are encouraged, and promising composers, artists, and writers emerge from the department of fine arts at the national university and from Chilean conservatories.

Chile has one of the best school systems in Latin America, with kindergartens, provision for vocational training, and other features of modern education. Education is free and compulsory for all children between the ages of 7 and 15, but this law is difficult to enforce, because the people in some regions are widely scattered and funds are frequently inadequate. Consequently, a large percentage of the people still are unable to read and write.

There are a number of fine institutions for higher learning. At Santiago are the University of Chile and the Catholic University; Concepción also has a university; and Valparaiso has one of the best technical institutes in Latin America. Scholarships are given to selected students for study in North America and Europe. Children of the wealthy receive at least part of their higher education abroad.

History

The Spanish conquest of what is now Chile was begun in 1535 by Diego de Almagro, a lieutenant of Pizarro (*see* Pizarro, Francisco). He was repulsed by the Araucanian Indians, but in 1541 Pedro de Valdivia, Pizarro's quartermaster, founded Santiago, the first white settlement. Colonization was slow and costly because the Araucanians destroyed settlements almost as soon as they were built.

While Spain was busy fighting Napoleon in 1810, Chile took steps to end colonial rule. In 1818 it declared its independence as armies under Gen. José San Martín, of Argentina, and Gen. Bernardo O'Higgins, of Chile, routed the royalists. O'Higgins was the "supreme dictator" of the new nation, until he was deposed in 1823. A period of strife finally led to the adoption (1833) of a constitution providing for a centralized government. This constitution, with few changes, remained the fundamental law for 92 years.

Throughout the 19th century the country made great progress. Foreign immigration and capital doubled the population between the 1840's and the 1870's and increased the national revenue five times over. While the other republics were being torn by continual strife, Chile suffered only one serious internal disturbance. This occurred in 1891, when a civil war resulted in the quick defeat of President José Manuel Balmaceda, who had attempted to rule without congress. The United States was briefly involved when its sailors were attacked (*see* Harrison, Benjamin).

Disputes over revenues from nitrate deposits in the Pacific coastal desert led to the War of the Pacific (1879–83), in which Chile crushed Bolivia and Peru, and emerged the great power of western South America. Chile took Bolivia's only strip of seaboard, the province of Atacama, and Peru's provinces of Tacna (later returned to Peru), Tarapaca, and Arica (*see* Peru). A long-standing boundary dispute with Argentina was settled peacefully in 1902 (*see* Argentina). The nation completed its portion of the Transandine railway in 1910; and, as part of a bargain with Bolivia, it completed a railway line between Tacna and La Paz in Bolivia in 1915.

The collapse of the market for nitrates after the first World War was a major disaster to the nation's economy. Discontent grew. In 1920, after the Conservatives had failed to heed demands for reform, Arturo Alessandri Palma, a Liberal, became president. Under his leadership a new constitution was framed in 1925, and progressive measures were adopted, providing for higher wages, better housing, social security, and better education. His successors pursued the policy. In 1943 Chile broke with the Axis. After the war Communism increased, and Chile was the first American nation to include Communists in the cabinet. It then banned the party in 1948. In 1951 Chile got economic aid from the United States and joined it in a defense pact in 1952.

Government

The constitution of 1925 provides for a highly centralized government. The president and congress, made up of a senate and a chamber of deputies, are chosen by popular elections. In 1949 women got the right to vote in the national elections. The president is elected for a term of six years but is not eligible to succeed himself. The president appoints the members of the supreme and appellate courts and the chief administrators (*intendentes*) of the 24 provinces. Senators are elected for eight years, and deputies for four. The Roman Catholic church, for centuries the state religion, was disestablished by the constitution of 1925. (*See also* Latin America; Latin American Literature; South America. For Reference-Outline and Bibliography, *see* South America.)

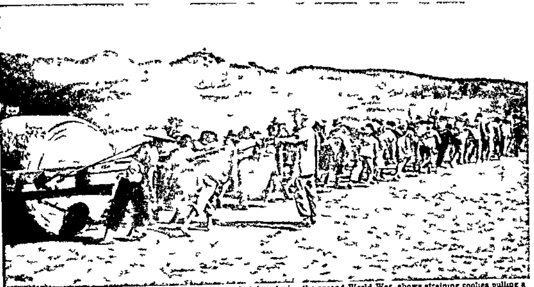
CHIMPAN'ZEE. Centuries ago visitors to equatorial Africa returned with startling tales of strange humans, frightfully ugly and tremendously strong. Probably what they had seen were chimpanzees, the large anthropoid apes, which frequent practically the entire Congo basin in Africa.

A full-grown chimpanzee is about five feet tall with arms spreading about six feet. It can walk nearly erect, but usually it touches its hands to the ground in walking. The hair is short and black or brownish-black; the almost human face is marked by prominent eye-socket ridges. Hands and feet have somewhat opposable thumbs and can grasp objects. Wild chimpanzees live in families, eating fruit, nuts, and insects, and building nests in the trees. They may live from 20 to 24 years.

Scientists have always been interested in the so-called "mental processes" of chimpanzees, which are the most imitative of apes and which can be taught a variety of human-like actions, such as eating at table with a knife and fork. Professors Kohler and Yerkes report instances of what resembles simple thinking, such as piling boxes one on another to reach a banana hung from the roof of the cage. The chimpanzee would first try each box separately, then apparently "think it out" and make the pile. These observers also report that some chimpanzees have learned the use and meaning of words, and they claim that one chimpanzee called "Cup! Cup!" when thirsty. Usual chimpanzee "speech," however, consists of mere cries indicating emotion.

Chimpanzees in captivity are often playful and affectionate, but grow morose and sullen with age. Usually they take affectionate care of their young. When removed from their native climate they are highly susceptible to pneumonia and tuberculosis. Scientific name, *Anthropopithecus niger.* (*See also* Ape.)

CHINA—*Vast Land of* YESTERDAY *and* TOMORROW



Old ways and new rub shoulders in China This photograph taken during the second World War, shows straining coolies pulling a heavy stone roller to smooth an air field for the powerful American planes that bombed Japanese held cities

CHINA Through many centuries China the oldest living nation was called changeless Its people had taken more than 3 000 years to build their unique culture They clung to traditional ways of life and ancient loyalties They shut the doors of the country against the outside barbarian world New ideas spread slowly among the nearly half a billion people

But a changing world did not leave China alone It has been torn and impoverished by wars between conflicting modern ideas and systems

More than a century ago Western traders broke down China s isolation and introduced the machine and its products The Industrial Revolution had brought wealth and power to the West But the tradition bound Chinese had little desire to follow their neighbor Japan in imitating Western industrialism Mass factory methods were uncongenial to the self reliant farmers and the painstaking artisans The dreamy scholars hated technical work Independent businessmen had no experience with the complex ways of corporations

Political revolution began in 1911 when the Chinese nationalists overthrew the Manchu emperors They proclaimed a republic and began the uphill task of converting a feudal nation into a unified democracy

Then in 1937 Japan invaded seeking to make China part of a military empire The people of Free China fought with a unity patriotism and competence that surprised the world But eight years of bitter war ravaged ports industries railways roads and communication systems and brought widespread suffering and loss of life

The Chinese Communists gained strength during the war With captured modern arms they pushed back the weakened and disorganized Nationalist forces By 1950 the Communists had overwhelmed China and the Nationalist government had fled to Formosa Conquest had been easy but could the new rulers solve the economic problems of the nation? Would the con servative Chinese adopt Communist methods?

The map shows why China was long isolated On the west it is closed in by high mountains and barren des-

Extent —(1) The Eighteen Provinces generally called China Proper have an estimated area of about 1 500 000 square miles and a population of 385 047 161 1947 est with a coast line about 1 600 miles long extending from 18 to 42° N latitude (2) Historic Greater China including Manchuria Inner Mongolia Western Provinces Formosa and Tibet has an area of more than 4 000 000 square miles and a population of 461 006 285

Natural Features —(1) North China The Loess Highlands North China Plain, Shantung Mountains, Hwang Ho (Yellow River) (2 Central China Tsinling Shan (rising to 10 000–12 000 feet) Red Basin of Szechwan North Yangtze Highlands Yangtze Lowlands Yangtze Kiang (Yangtze River) (3) South China South Yangtze Highlands Southwestern Highlands Si Kiang Basin, Southeastern Coast Si Kiang (West River)

Climate —Mean temperature North China Plain from 25° F in January to 80° F in July Yangtze Plain, from 40° F in January to 85 F in July South China from 55° F in January to 88 F in July Average yearly precipitation North China 15 to 20 inches Central China 45 inches South China 60 to 80 inches Winter monsoon October to April summer monsoon, May to August

Products (1) Agricultural Rice wheat kaoliang millet barley corn, oats cotton silk tea peanuts sugar, soy beans tobacco sesamum rapeseed sweet potatoes and other vegetables melons, peaches pears and other fruits opium hogs and poultry (2) Fish (3) Mineral Coal antimony tungsten manganese tin zinc lead pottery clays building stone alum soda salt gypsum iron copper silver (4) Forest Tung oil bamboo camphor (5) Manufactured Cotton silk, rayon and woolen goods iron and steel paper cement chemicals canned goods glass and porcelain egg albumen sugar flour carpets embroideries and laces electrical goods soap

Cities —Shanghai 4,300 630 Peking Communist capital (Peiping over 1 400 000 Nanking Chungking over 1,000 000) Tientsin Canton over 1 000 000 Tsingtao Hankow Chengtu, Sian Changsha Soochow Foochow Tsinan (over 500 000 Hangchow Changsha over 325 000 British Colony of Hong Kong (1953 est 2 250 000

erts. On the east the vast Pacific Ocean forms a barrier which men could not cross until modern times.

As we have seen, China was shut away, too, because of its wish to be left alone. Thousands of years ago the Chinese learned how to live comfortably together and to create things of beauty. They invented porcelain and gunpowder and paper and printing. They were the first to print books, and for a long time they had more books than all the rest of the world. At the time America was discovered they were in many ways the most civilized people on earth. Their lack of interest in the outside world was strengthened by their greatest thinker, Confucius, who taught them respect for the ways of their ancestors.

While the Chinese were shut away, the Western nations drew ahead. When they finally forced their way into China the people there were surprised to learn that the newcomers regarded them as ignorant and backward.

The Land and the People

NO ONE KNOWS exactly how large China is, or how many people it has. The land has never been surveyed and no complete census has ever been taken. If we include all the territory that the government regards as Chinese, Greater China covers about 4 million square miles. This is larger than all Europe and almost as large as Siberia. But China's control over the territories of Tibet, Outer Mongolia, Manchuria, and Sinkiang (Chinese Turkestan) has varied (*see* Manchuria; Mongolia; Tibet; Turkestan). The area of "China proper" covers about 1½ million square miles, and includes the 18 provinces shown on the map on page 260.

In 1947 the Nationalist government, then in power, estimated the population of China to be 461,006,285—about one fifth of all the people in the world. This figure included 385,047,161 for China proper (the 18 Central Provinces) and 75,959,124 for the outlying provinces and territories (Manchuria, Inner Mongolia, Western Provinces, Tibet, Formosa, Jehol, and 12 municipalities).

Thus China proper has two and a half times as many people as the United States crowded into less than half the area. But the Chinese are even more badly crowded than would appear from this comparison. In the United States three-fourths of all the land is in farms or is used for grazing live stock. In China proper less than one-third of the land, at the most, is used for farming or pasture. Some estimates are much lower than this. Using this largest estimate for China's crop and pasture land, we find that there are 12 persons to be supported by every 10 acres, against one person in the United States for every 10 acres. And there seems to be little possibility of bringing much more of the land under the plow. More than half of the land can never be farmed, because it is too mountainous or too dry, or because the soil is too poor.

A Land of Mountains and River Valleys

China proper is shaped almost like a palm-leaf fan. The northwestern province Kansu is its handle and the other 17 provinces spread out from it, with the rounded edge of the fan lying along the Pacific coast.

This coastline extends from about 18° to 42° north latitude—a little farther south and not quite so far north as the Atlantic coast of the United States. At its widest point China proper extends from 122° to 93° east longitude. So it is only about half as broad as the United States. The northern third of the coast is a low-lying delta plain fringed with sand banks. Hence it has few good harbors. But south of Shanghai the drowned coastline, with its numerous little islands and bays, provides many safe shelters for ships.

In describing the land, one thinks first of mountains. China is a land of rugged highlands, and only in the river plains are there any large areas of level land. The mountains run for the most part from west to east, and they become smaller as the land gradually slopes off toward the sea from the high plateau of Tibet. Some lie in ranges; others stand in isolated groups or clusters. The central mountains are a continuation of the Kunlun Range of the Tibet-Sinkiang border. The chief range, the Tsinling (*jē-ling*) Shan, extends almost to the coast. These high mountains, rising to more than 10,000 feet, divide China geographically into two parts, which differ greatly in climate, in the general appearance of the land, in agriculture, and in the activities of the people.

CAVE DWELLINGS IN THE WIND-BUILT SOIL OF NORTH CHINA

A stream has cut down through the thick layer of *loess* soil that covers the plains of northern China, showing the formation of this fertile crust. In such places millions of people have dug out homes, stables, and storehouses.

This map shows the physical nature of Greater China a vast region which stretches one sixth of the way around the earth Within this region to the west, are the highest mountains in the world the Himalayas and the Pamir Plateau the so-called roof of the world North of the Himalayas begins a broken line of lower ridges and plateaus that sweeps east then north to separate a fertile eastern China from the rugged desert interior The rivers which drain east and southeast from the mountains have brought down soil and enriched their lower valleys In these valleys live most of the Chinese people

In the western part of north China are the Loess Highlands so named because they are covered with wind blown soil called *loess* This has blown down to cover most of the North China Plain east of them In the extreme east is the mountainous peninsula of Shantung where the sacred mountain T'ai Shan is the highest peak (*see* Shantung) Most of south China is a region of hills and narrow valleys called the South China Highlands The southwest is a plateau which rises in broken steps to the heights of Tibet

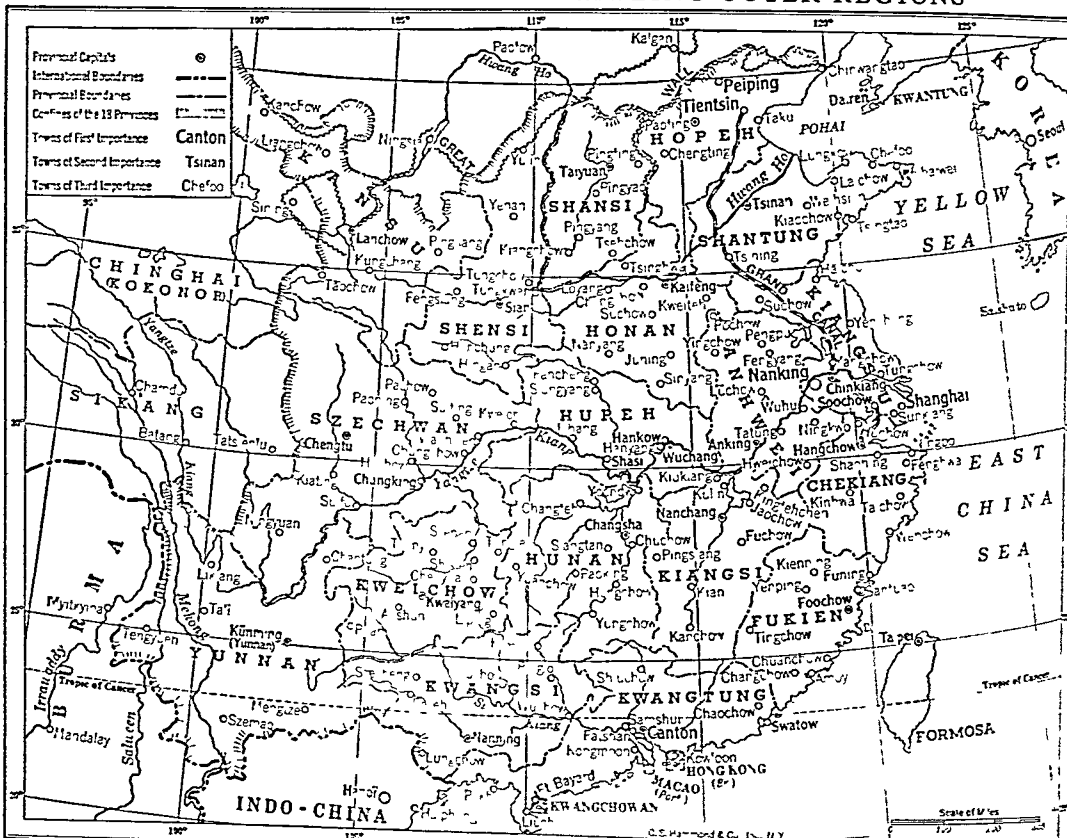
Many rivers cut through this rugged land On them China depends for its life for without them it could not grow enough food for its people The three great rivers rise in the mountains of the west and flow generally eastward to the sea Through north China flows the Hwang Ho or Yellow River In its lower port on the Hwang has formed a broad fertile plain—the North China Plain The Yangtze the greatest river in Asia drains central China About midway in its course from Tibet it waters the mountain rimmed Red Basin of Szechwan (*su-chuan*) so named because its soil is colored by red sandstone The province of Szechwan is the richest and most populous of all the provinces As it nears the sea the Yangtze is bordered by broad lowlands A much shorter river the Si Kiang or West River is the chief stream of the far south Like the Yangtze it has built a broad rich delta near its mouth In the valleys and plains of these rivers are crowded most of the people for these regions have most of the level land and fertile soil for farming (*See* Hwang River Yangtze River)

Wide Range of Climate

North China has short hot summers long severe winters and scanty rainfall The average temperature in January is under 25° and in July it is about 80° In the south the summers are long hot and moist the winters mild and the rainfall abundant Even in January the average temperature is above 50° in the far south An important influence on the climate is China s position in the southeast of the vast continent of Asia The interior of Asia is one of the driest regions in the world with extremes of heat and cold These differences in temperature cause seasonal winds called *monsoons* (*see* Winds)

The monsoons bring heat and cold rain and drought The winter monsoon (October to April) blows from

CHINA'S HEARTLAND AND SPRAWLING OUTER REGIONS



The 18 provinces named in large, very black capital letters form China proper. Lighter capital letters for Chinghai and Sikang, in the west, show areas where Chinese control varies. Sinkiang, in the northwest but not shown, nominally belongs to China, but is largely dominated by Russia. Formosa became a province of China in 1947, but became a Nationalist refuge in 1949.

the northwest and west, bringing bitter cold to north China from the cold dry interior. The warm summer monsoon (May to August) blows from the south and southeast, laden with moisture from the ocean. It brings heavy rains (about 60 inches a year) and a long growing season to the south. As it crosses the central mountains, it loses much of its moisture, so that precipitation in the north is scanty (15 to 20 inches) and less certain. It usually brings plenty of rain to the North China Plain in July and August, but when the rains fail people starve by the million.

North China and Its People

The North China Plain is brown and bare, with scarcely any trees, but its loess soil is amazingly fertile, when it gets enough rain. Sometimes the Yellow River overflows when the rains come, and terrible floods ruin the crops and destroy millions of people.

The people of the north are tall and broad-shouldered, with high cheek bones. They are slow of speech, and the people of the south consider them rather dull. These northern people like to eat bread and noodles, made from the wheat they grow. But they have to sell much of their wheat to get money. So a large part of their diet consists of millet, oats, corn, and kaoliang (a tall sorghum, pronounced *kow-lĭ-ăng*), which are not so nourishing or so pleasant to the taste as wheat.

The cities are low and flat, with few buildings more than one story high. Peiping (Peking), the most famous of the northern cities is remarkably beautiful, with its imperial buildings, its temples, and its shrines. It has been the capital of China at various times and much of the nation's history centers around it. The chief seaport is Tientsin. Other important cities are Chefoo and Tsingtao on the Shantung peninsula. (*See* Peking; Shantung; Tientsin.)

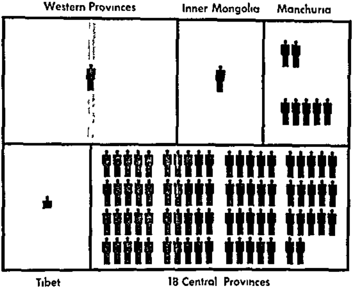
South China and Its People

In south China everything is softly green, with a greenness which one has to see to believe. For here the climate is warm enough to grow rice, and young rice is the clearest of greens. There are trees, too, and soft fernlike bamboos, and lakes and ponds and rivers. The cities are busy and many of them have high buildings copied from those of Western countries. The people are smaller and quicker in their movements than the northerners. They laugh and talk and lose their tempers more readily.

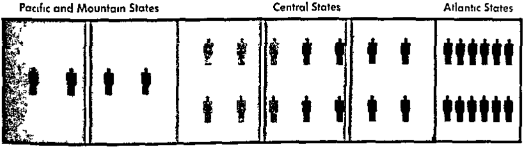
In the rich valley of the Yangtze there are more than 670 people on the average to each square mile of

China and the United States Compared

Area and Population of Greater China



Area and Population of Continental United States



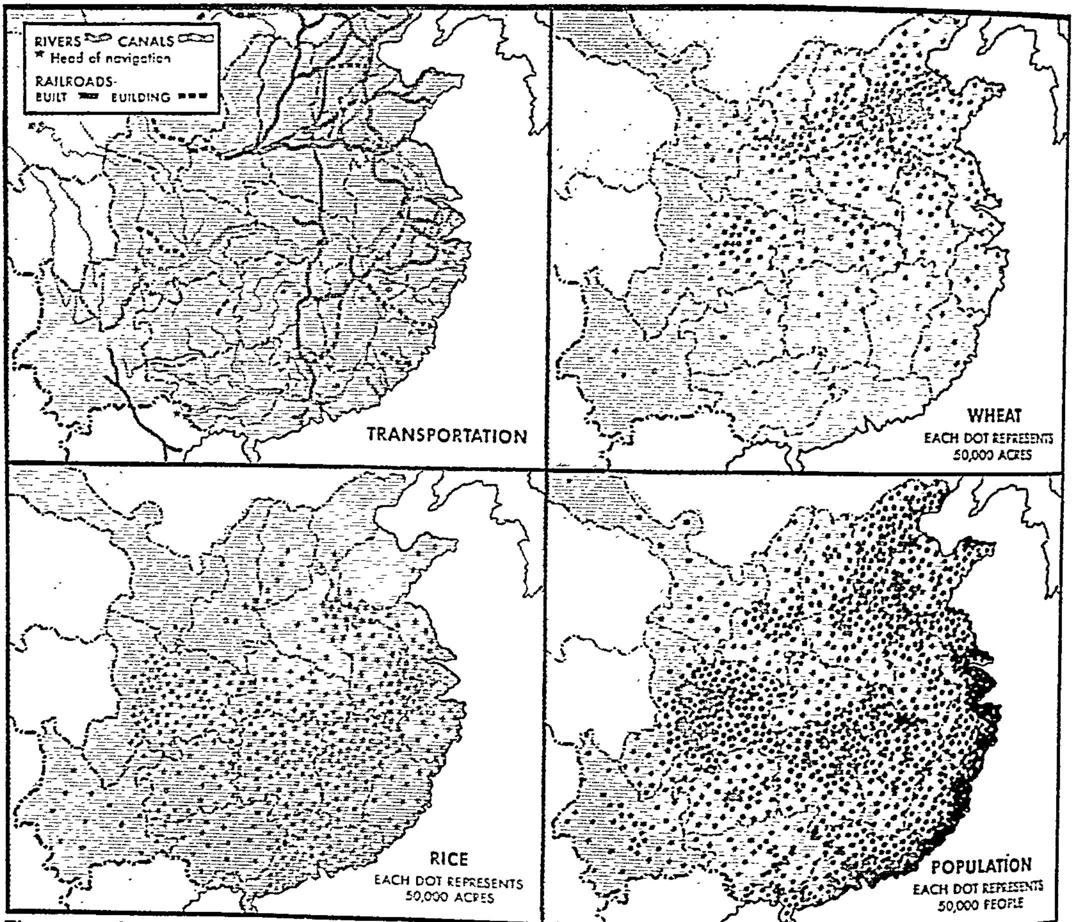
Each rectangle represents 500,000 square miles

Each complete symbol represents 5,000 000 people

Prepared for Compton's Pictured Encyclopedia © International Foundation for Visual Education

farm land Some parts have 2 000 or more to the square mile No other region in the world, it is said, has so many navigable waterways Besides the great river and its tributaries, there are more than 100 000 miles of canals These take the place of roads, for nearly every village is on a canal Rice and tea are the chief crops Along or near the river are several great cities—Nanking, which has several times been the capital, Shanghai, the most important commercial city and one of the world's busiest ports, Hangchow, a beautiful city which still retains some of its ancient historical charm, and the triple city group of Hankow, Hanyang, and Wuchang which are 600 miles from the ocean but are reached by seagoing ships. (*See* articles on these cities)

In the tropical and subtropical south the farmers grow chiefly rice Tea corn, and tobacco are other important crops Mulberry trees are cultivated for their leaves, which are used for food for the silkworms Most of China's silk comes from the delta of the Si Kiang (West River) Near the mouth of this river stands Canton, whose enterprising people are



These maps show the chief transportation routes of China, where wheat and rice are grown, and how the people are distributed.

found doing business all over the world. Hong Kong, which belongs to Great Britain, is an island lying just off the coast near Canton. Foochow is another important city. (*See* articles on these cities.)

The people in various parts of China speak different dialects and differ from one another in other ways. Lack of transportation and communication has kept the folk of one region from knowing those of another. This is one reason why the Chinese have not had so strong a sense of nationalism as many other peoples and why it is hard for a government to enforce laws, change methods or institutions, or provide common schools.

How the People Live

THOUGH regions differ in climate, soils, resources, crops, customs, and languages, the Chinese have certain problems and qualities in common. In general, they are remarkable for their industry, patience, endurance of hardship, love of peace, honesty, and courtesy. Because there are so many to feed from every square mile of land, they are hard-working, saving, and skilful in farming. Even so, there is not enough for all, and the common people all suffer from lack of proper food and warm clothing. Four-fifths or more of the population are farm people. The whole family—men, women, and even little children—have to work early and late to make their tiny farms produce enough food to go around. Most families have less than four acres of land, and each farm usually consists of five or six scattered strips, like the farms of medieval Europe.

Life of Village and Farm

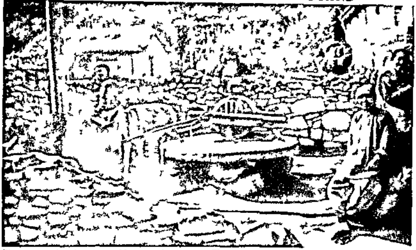
The farmhouses are generally clustered in little villages and the farmers have to walk some distance to their fields. The usual farmhouse is mud-walled, with a roof of thatch. In the north the walls are reinforced with kaoliang stalks. Houses in the south may have walls of brick or woven bamboo. Wood is scarce, and the farmers use it sparingly for roof beams, farm implements, coffins, and furniture. The floor is merely pounded earth. The tiny window opening has merely a lattice of wood covered with paper, because glass is scarce and costly.

A whole family—grandparents, parents, and children—lives in a homestead made up of several houses grouped around an open courtyard of hard beaten earth. Here the women sit spinning and mending and

preparing vegetables to be dried or salted for winter use. Here the children play, the old people sit in the sun, and chickens and pigs roam in search of stray bits of food. Usually a grove of trees near the homestead gives shade in summer. Beneath it may lie the family graves.

At one side of the entrance to the yard are two or three great sunken jars which hold human and animal manure for fertilizer. A pond or a small canal near by is probably shared by several homesteads for washing clothes. The women soap the clothes with either coarse yellow soap or a large soap bean and beat them with heavy wooden paddles on a rock. Then the clothes are rinsed and beaten again. In the same pond or canal vegetables and rice are washed for cooking, utensils are scoured out, and water is drawn for brewing tea, for washing faces and hands, and for watering seedling rice and vegetables. The men carry the water to the fields in great wooden buckets slung on a pole and spray it out skilfully in an even sheet with wooden dippers.

LIFE IN A NORTH CHINA COURTYARD



The courtyard is the center of household activities. These farmers are fortunate, for they have a little donkey to grind the grain. Blindfolded he plods round and round, turning the heavy millstone on the grinding table. To the left is the mud-walled, thatch-roofed farmhouse with its latticed window. Notice that the woman in the foreground has the tiny lily feet of old China.

In northern farmhouses most of the scanty furniture is made of mud dried until it is very hard. The most important piece, the *kang*, is a bed built of brick or mud and kept warm by a small fire underneath it. During the cold winters when little farm work can be done the family spends much time sitting or lying on these beds, which are spread with quilts over straw or *kaoliang* stalks. In the south the furniture is of wood and there is no need of a *kang*.

TERRACES OF RICE

Far up on the mountain sides the farmers have leveled and walled off tiny plots for rice growing

Cooking and Food

The kitchen stove, too, is of mud or in some places broken brick. The pots which are set down into it are of iron beaten so thin that little fuel has to be used to heat them. Fuel is commonly straw or grass because wood is scarce. Every handful of grass and every stray twig is valuable.

The women of the north cook noodles in boiling water and bake flat pancakes without yeast or shortening. Both these dishes are flavored with a little chopped garlic, soy bean sauce or pickled bean curd. The southern people eat rice with some sort of vegetable heated quickly with a few drops of vegetable oil and salt and a spoonful of soy bean sauce. Both the noodles of the north and the rice of the south are eaten with chopsticks. The common people rarely have meat of any kind. Sugar is seldom used except on holidays, and the ordinary shortening is rapeseed, bean or peanut oil.

VILLAGE LAUNDRY

The canal is the community water supply, kitchen sink, laundry and meeting place

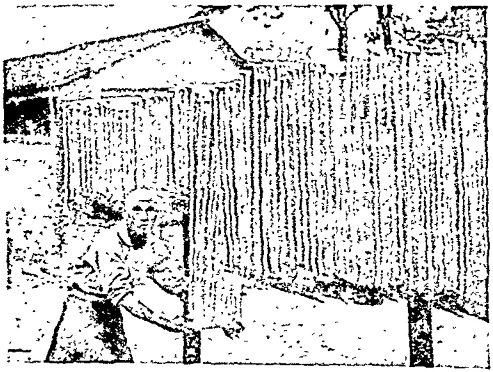
The better farmhouses and the houses in the towns usually have one guest room or living room in which hang a few painted scrolls or the wooden tablets bearing the names of the ancestors. When there are guests or important family celebrations the meal is served here.

Fashions in Rural China

The women not only help in the fields and do the washing and cooking but they spin and weave and make garments for the family. Styles in clothing are the same north and south. The men wear loose baggy

HARD WORK AND SCANTY LIVING

Two factory girls ride to work over a rough road near Shanghai in a one-wheel taxi—fare, a few cents an hour.



What looks like a week's laundry on the line is really a batch of fine Chinese noodles hung out to dry.

The teeth of that peculiar saw are filed in reverse, so they cut on the pull stroke instead of on the push stroke.

Many people live their whole lives aboard sampans. At the left, a little boy with a net is scooping up pieces of floating wood.

trousers and long, high-collared gowns of blue or gray cotton cloth, reaching to the ankles and open at the side seams almost to the knees. On dress occasions they may wear short black jackets over the gowns. These are cut like the gowns except that they come only two or three inches below the waist and open down the center. In winter the gowns and perhaps the trousers are padded with cotton and quilted, to make them warmer. Several layers of garments may be worn in cold weather. Those who can afford it line the outer garment with sheepskin or other fur. Women on the farms usually dress just like the men, except that instead of the long gowns they wear jackets reaching only to the knees. Dark blue and black are the ordinary colors, but in summer even a farm woman may wear pale blue or lavender. To keep the wind from blowing their sleek black hair, women working in the fields usually wear a square of flowered cloth over their heads tied beneath the knot of hair at the back of the neck. In summer men wear great straw hats. In winter, when a man gets ready to go to town, he puts on a small black sateen skullcap with a button on the top—a white button if he has had a death in the family, otherwise a red or black one. All the common people wear homemade cloth shoes or straw sandals woven by some member of the family or bought at the nearest village for a few cents. Leather shoes are worn only by students and merchants and the wealthier people of the cities.

Seafaring People of the South

Along the southeast coast and up and down the rivers and canals in that region are most of the seafaring people, the fishermen, and the houseboat people who live all their lives on their *sampans*. In the south timber for boats is still plentiful, there are innumerable harbors for small craft, and the land is overcrowded. Consequently many have turned to the sea for a living. Fishermen in their gaily decorated junks sail out into the open sea or take shrimps, oysters, and prawns near the shore. Their catch is important, for no feast is complete without fish. The larger seagoing cargo junks carry on a considerable trade with neighboring lands. The crews on these junks and even on the modern steamships have usually begun their training in seamanship on the small fishing boats.

The Contrasts of City Life

In the larger cities and towns, the new China rubs elbows with the old China in bewildering contrast. Some men wear European clothing. Side by side with them are well-to-do merchants of the old school clad in long silk gowns and coolies (laborers) in blue cotton trousers and short jackets. Rarely, except in remote country towns and villages, does one see the queue, or pigtail, which men were formerly obliged to wear as a mark of submission to the Manchu rulers. Some of the women dress in Europeanlike costumes, with bobbed and waved hair, and high-heeled shoes. Others wear the new long

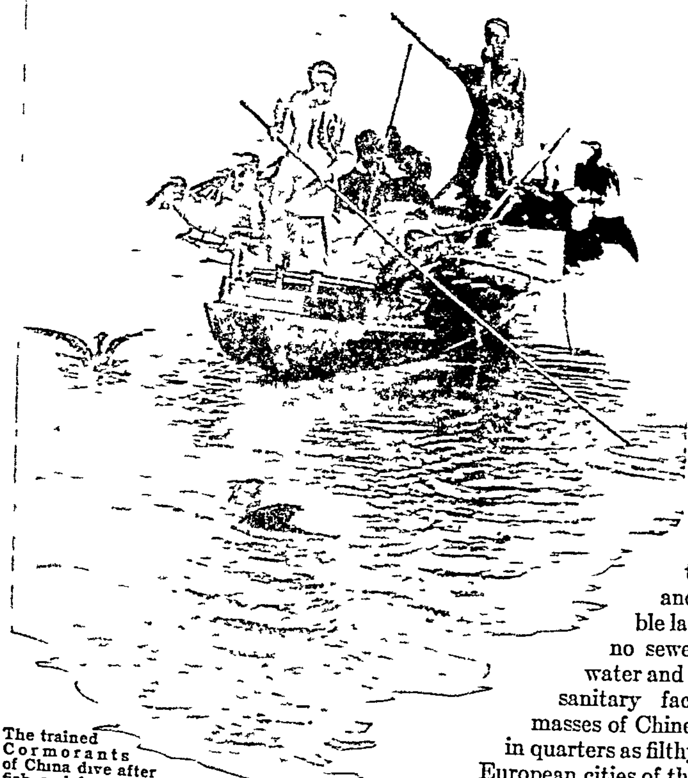
CONTRASTS IN CHINA'S MYRIAD PEOPLE

hese photographs show only a few of China s many types Despite their different appearances many tend to cling to China s ancient traditions Masses of Chinese remain largely unchanged in spite of revolutions invasions and Communist upsurge

silk gowns, much like the men's except that they are brilliant in color, fitted to the form, and slit to the knees. Some of the women totter on tiny stumps of feet, for the old custom of foot-binding is still practised in many families, although it is forbidden by law. For centuries it was customary in most parts of China to bind the feet of little girls so tightly that the feet ceased to grow, the toes curled under, and the bones were distorted. Tiny deformed feet were considered a mark of beauty.

THESE BIRDS CATCH FISH FOR THEIR MASTERS

As you walk along the older streets, narrow and crooked, you find them lined with picturesque shops The fronts are ornamented with gilded and elaborately carved woodwork, and decorated with banners and flags When you hear the discordant music of a band from an upstairs room, you know that the shop is having a bargain day or an opening day. The streets are jammed with people on foot, riding in rickshaws (little two-wheeled carriages drawn by men), or in sedan chairs borne on men's shoulders Some ride in wheelbarrows with seats In these narrow streets there are no automobiles But only a block away there may be a broad motor boulevard lined with trees, motion-picture houses, modern department stores, neon signs, apartment houses, and hotels several stories high. The large cities have sections that are almost entirely modern, with electric lighting, telephones, and modern factory districts as well as residential and shopping areas These new districts are in glaring contrast to the old sections where most of the people live in wretched, crowded tenements Three or four families may live in one small room The narrow streets are filthy, for all sorts of refuse is thrown into them Many of the streets are unpaved except for a single row of paving blocks down the middle, and in the rainy season they become seas of mud In others the paving has worn out in places, leaving deep holes through which people and draft animals stumble laboriously. There are no sewers to drain off rain water and wastes, and no other sanitary facilities. The great masses of Chinese city dwellers live in quarters as filthy and smelly as were European cities of the Middle Ages But to see only the cities is to see the smallest part of China, for China is chiefly a country of hard-working farmers and painstaking village craftsmen. In the villages you will see the old blacksmith who molds and shapes the hoe heads, the spades, the plow points, the meat cleavers, the vegetable choppers. There, too, you will see the carpenter who makes a plow or a harrow, a bed frame, a table, a bench; the tailor who shapes a garment and pads it smoothly and carefully; the turner who makes wooden tubs and buckets and baby rockers; the stonecutter who shapes the millstones to grind the meal or hull the rice. These and the farmers make up the real China.



The trained Cormorants of China dive after fish and bring them back to the boat. They cannot swallow them since they wear tight "neckties" At meal time the knot is untied and they get a share of the day's catch.

"FIRST GRADERS IN A VILLAGE SCHOOL

n the villages of north China many of the classes are held out of doors when the weather is fine There is frequently on y one teacher o some 200 pup s so the older pup ls have to he p with the younger ones The blackboard is fastened to a mud wall The sma l pupils ho d their w ting pads on thei knees as they st ve earnest y to write the difficult Chinese characte s

The Boys and Girls Games and Holidays

WHEN A BOY is born there is great rejoicing Every man wants sons to carry on his name to honor him when he dies and to continue he worship of his ancestors A son when he is old nough to earn a living contributes his earnings to the amily *income He brings his bride to live in his* ather s household and she helps in the home

Girls are not so welcome especially among the poor *t is expensive to marry off a daughter for her father* nust provide everything she will need in her new home ind she is of no use to her family after she marries or she serves her husband s mother and worships his ancestors An old proverb says that one deformed son is better than 18 daughters as wise as the apostles of Buddha

VRITING WITH A BRUSH

This boy is studying in the family ourtyard Beside the flower bowl is block of *ink and a second brush*

How Ages Are Reckoned

A child is considered to be a year old *when he is born* Everyone adds a year to his age on *New Year s Day* rather than on the anniversary of his birth and so a baby born a week before New Year s becomes two years old on that east day According to the old Chinese calendar a nonth begins with a new moon and New Year s Day omes with the second new moon after the winter sol tice It may fall therefore as early as January 20 or as late as February 20 The government has adopted the same calendar that we use but the people still cling to their old way of dividing the year and to the festivals that for thousands of years have been held on certain days of their year

When a baby is a month old a great feast is held All the relatives and friends are in*vited and the child is given a* milk name A boy may be called Little Stupid or Vag abond or by a girl s name so that evil spirits will believe h s parents care nothing about him and will leave him alone Later when he is of school age the child receives his book name

CHOPSTICKS

Warm as toast in her many coats a girl eats a *sweet f om a street* vendor s cart

Boys are likely to be badly spoiled Everyone in the household pets them and they are given everything they cry for The lot of their sisters is quite different Girls may not play with boys They are taught *to wait on their elders and on* their brothers In families that cling to the old ways they are more or less *ignored and their happiness is not much considered*

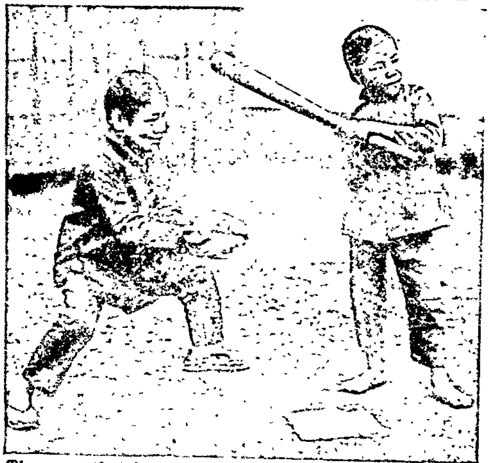
At Work and at Play

Both boys and girls are dressed exactly like grown ups except *that in hot weather* they wear as few clothes as possible A farm boy working in the field wears only a pair of coarse blue trousers rolled up to the knees but in cold weather he puts on one gar ment after another until he looks as broad as he is

long. Poor children wear cotton; those of wealthy families have embroidered silks and satins.

Children are taught reverence for their parents and that it is an honor to marry and have many sons. Families have often arranged marriages when the boy and girl were babies. In 1950 the Communists tried to stop this by decreeing that girls be free to choose their own husbands.

THEY LIKE THE AMERICAN GAME



The game that American boys love is just as popular with Chinese boys who have learned how to play it. These players are pupils at an American mission school.

In farm families children begin to help in the fields when they are scarcely more than babies. In the cities thousands of children of poor families are apprenticed to shops and factories. The hapless youngsters work long and hard and expect little reward for their labor. More fortunate children start to school when they are six years old.

UMBRELLA HAT

Rain does not worry this baker boy. He shields his cakes with his hat, made of straw and oiled paper.

The Chinese are by nature a fun-loving people, and children have their good times in spite of hard work and lack of luxuries. They like to play coin games and ball games, hopscotch, and shuttlecock, played with heels and toes. For some there may be an occasional theatrical performance or a Punch-and-Judy show. Toys are scarce and they are made of perishable materials—paper, bamboo, clay, colored sugar. At New Year's time, however, almost every child has a toy for at least a day. Lanterns, singing tops, gaily painted clay dolls, and sugar images are everywhere. Best of all are the festivals, when gaiety reigns for old and young alike. The New Year's festival is the greatest of all. Preparations go on for weeks beforehand, shops are closed for several days, and families gather for the feast, much as they do at our Christmas season. The houses are decorated with streamers and banners of bright colored paper, and all but the beggars have some little sign of gaiety, if it is only a fresh strand of red cord braided into the black hair of a child. The season is the time for paying debts and for sending food to the poor.

On New Year's Eve there are bonfires and firecrackers, feasts are laid before the tablets of the ancestors, and everyone stays up all night. One ceremony is the burning of the kitchen god. Chinese families keep a picture of this deity hanging over the stov Before New Year's it is taken dow and burned in the courtyard or stree Thus the god is sent to heavei where he reports on the life and actio of the family. In the first hours o the New Year he is received back agai and a new picture is put up. The New Year's festival ends two weeks later with the Feast of Lanterns, perhaps the most beautiful of Chinese ceremonies.

WATER BAB

The life preserver on her back will save her if she falls into the water.

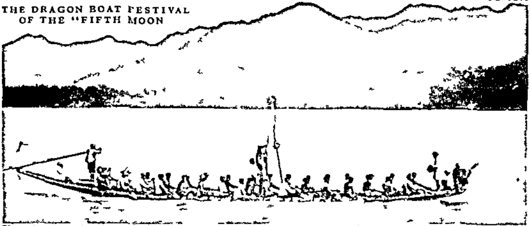
The Dragon Boat Festival, held on the fifth day of the fifth moon, is another exciting occasion. It is said to have arisen from the search for the body of Ch'u Yuan, a statesman who drowned himself in 295 B.C. Daring boat races are held in boats decorated to honor the Dragon, a water god. Great crowds gather to watch the races, which frequently result disastrously. On the fifteenth day of the eighth moon the Mid-Autumn Festival takes place. It is celebrated in honor of the full moon, which symbolizes concord and harmony.

Another special occasion which the children love is the Kite-Flying Festival. On the ninth day of the ninth moon all the children, and even the grownups,

FORTUNATE YOUNG MISSES

These smiling young misses and their tiny sister are dressed in silks and brocades, for their father was a well-to-do merchant of Peiping. They have combined the Chinese style dress with Western shoes and socks.

THE DRAGON BOAT FESTIVAL OF THE "FIFTH MOON



The ancient dragon boat races are somewhat like an annual regatta. Long narrow boats decorated to represent dragons are paddled swiftly through the water by crews sitting two abreast. In the center of each boat a drummer beats time on a drum and gong. The people eat rice cakes during the Dragon Boat Festival and a man in the bow of the boat pretends to throw rice to the water dragon

go out to fly kites from the hilltops. Many boys make their own kites carefully calculating the weight and measurements. Some make beautiful octagonal kites painting the legend of the eight immortals on them and then oiling the paper. They hang whistles wind organs and bells from the corners and tie gay little lanterns to the tails. They also make butterflies dragons and other beautiful or fantastic shapes.

Farming Methods and Products

WHEN YOU greet a friend in China you ask politely Have you eaten? Food is the most pressing problem of the Chinese millions and they all depend on the labor of the patient hard working farm people. The farmers grow crops on every inch of their farm land except on the grave mounds which in some regions take up as much as 9 per cent of the farm area. They even terrace the hillsides in some places as high as 8 000 feet to provide more land for planting.

In spite of all the farmer can do however millions starve to death when droughts floods or locusts ruin the crops. Weather is fickle in China and the Chinese as they say depend on Heaven to eat. Almost every year there is a famine in some province. Even though food may be plentiful in one part of the country people in another part may starve because there is no way to get supplies to them.

All over China farming is more like gardening than like farming in the United States. Fields are so small that they look like truck gardens. The farmers do all the work by hand for they could not use machines on such small and irregular patches. Tools are primitive—a hoe a bamboo or crude iron rake a long handled sickle a homemade flail. The typical Chinese farmer knows nothing about scientific seed selection and other aspects of modern scientific farming.

Floods and Irrigation

The farmer's worst trouble is too much water or too little. Three thousand years ago the government began to build dikes and canals to control floods and irrigate the land. Today the country is crisscrossed with waterways that irrigate nearly half the cultivated land. Neighboring villages and individual farmers combine to keep the dikes and sluices in repair dredge canals and water their crops by little streams led in channels through the fields.

Cooperation in China says one author finds its most striking expression in the control of water. In some regions for example if a canal runs through a number of villages each village uses it in turn by agreement the time of use by each farmer being regulated by the burning of an incense stick.

Irrigation is needed especially to grow rice which is the largest crop and the *staple food in the south*. The rice fields are surrounded with little mud walls so arranged that the fields can be first flooded with water and later drained (*see* the picture on page 263). Where the fields are above the level of the canal or stream the water is raised by hand or by clumsy pumps. A common form of pump is an endless chain of wooden paddles that push the water up a

MORE HOMES FOR THE DEAD THAN FOR THE LIVING

In these earthen mounds lie the bones of former generations. Held in great reverence they must never be disturbed. Much farm land is thus lost and railroad building is handicapped.

slanting trough. This may be worked either by a cow or a water buffalo or by a treadmill which men turn with their feet.

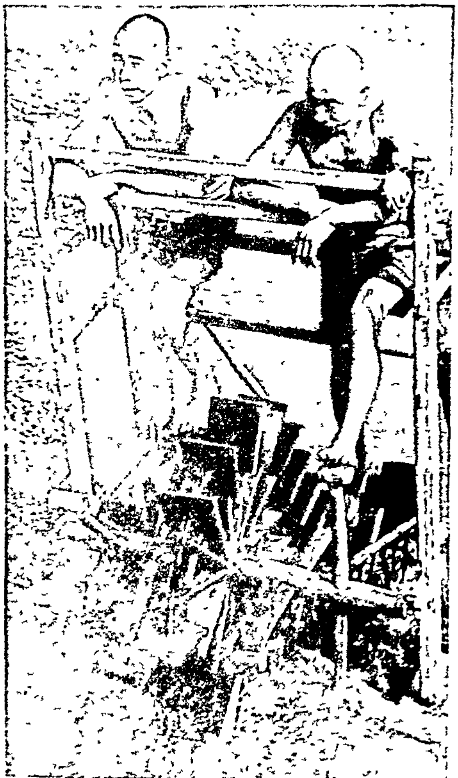
Increasing the Yield

To fertilize his fields the farmer uses human, animal, and plant wastes; ashes; bean cakes and other kinds of oil cakes (the product left from seeds after the oil has been pressed out) and canal mud. He takes the mud from the beds of streams, thereby deepening the waterways and raising his fields as he spreads it over them.

By planting two crops, and in some sections three, or even four crops a year, the Chinese produce nearly twice as much rice an acre (52 bushels) as any other farmers in the world except the Japanese. Wherever possible, they grow rice, because it yields more food to the acre than other grains.

In the wheat regions the farmer increases production by planting other crops between the rows of growing grain. Wheat, the second crop in acreage, is grown chiefly in the north. There it is sown in the spring. Farmers south of the central mountains sow winter wheat after the rice crop has been harvested and the fields have dried.

IRRIGATING BY FOOT-POWER



Patiently these farmers tread their water wheel, pumping the canal water up into the rice paddies. Many Chinese farmers have water buffaloes for this work. Only a few have pumps operated by oil engines.

Crops, Old and New

Although China is one of the world's greatest producers of rice, wheat, kaoliang, millet, barley, corn, sweet potatoes, and possibly of sugar cane, it cannot make one acre of ground produce enough food for two persons. It has to buy a great deal of rice, wheat, flour, and sugar from other countries. The useful soybean is another important crop (*see* Soybean). Peanuts have become a large crop since a missionary half a century ago found that they would grow well in the sandy soil of the Shantung peninsula. Rape and sesame are produced for their seeds. These, like peanuts, are used as food and also furnish oil for cooking, for soap, and for lubricating purposes. Vegetables of many kinds are grown everywhere. Tobacco is grown, but there is not nearly enough to satisfy the needs of the Chinese, who are great smokers.

Large orchards are rare, but apples, peaches, pears, and apricots are grown on a small scale in many places. The south has oranges, tangerines, bananas, litchis, and other subtropical fruits. Melons are a favorite crop, for dried melon seeds are a delicacy served with tea.

Much land which might be used to grow food is given to the opium poppy, for opium can be marketed very profitably. It brings a good price and can be easily and cheaply transported, but by taking the place of food crops it helps to produce famines.

Tea and silk were China's special gifts to the world. China was for centuries the leading producer of tea, but it now supplies little of the tea that is shipped to Western countries. Chinese farmers grow tea in patches around their homesteads and prepare it by ancient hand methods. (*See* Tea.) Most of the tea crop is grown in the central uplands, on the ranges of the southern coastal provinces, and in Szechwan. The mulberry trees of the lower Yangtze Valley feed the worms that produce the finest grade of white silk. The Canton Delta is another famous producing region. Tussur silk comes from Shantung province, where wild silkworms are fed on oak leaves. But Japan, with its more modern methods, has replaced China as the leading silk producer (*see* Silk). Cotton growing is a newer industry, for it was introduced from Central Asia only some eight centuries ago. As the number of modern cotton mills in the country has grown, production of raw cotton has recently increased, until today China is among the leading cotton-growing nations.

Farm Animals in a Crowded Land

Have you wondered why there has been no mention of dairy products in all this discussion of Chinese farming? Most Chinese farmers raise cattle, not for milk or meat, but only for work animals. They cannot afford to have dairy herds or meat herds because it is cheaper to grow crops for food than to use the land for feeding cattle and then eat the animals and their products. Few Chinese ever taste cow's milk or butter or cheese.

Oxen, water buffaloes, donkeys, and mules are the commonest work animals. Hogs and chickens are raised because they can be fed on refuse. In the south large numbers of ducks are raised when the rice fields are flooded. Strangely enough, this land of few farm animals and no chicken ranches is the chief producer of egg products for export to bakeries in the United States. For shipment, eggs are frozen or dried; or they are shipped in bulk with the shells removed or

A GIANT CRAZY-QUILT OF RICE PADDIES

From the air China's tiny fields make a queer looking patchwork. The flooded paddies reflecting the sun appear like fragments of glass. The canal through the center and the dikes around the little plots stand out clearly. You can also see the village in the distance at the left. Every day the farmers must walk from their homes in the village to their scattered fields.

made into prepared albumen and yolk. Pig bristles are also exported to make durable toothbrushes and hairbrushes.

Financial Problems of the Farmer

The Chinese farmer in general sells the best of what he grows and uses the inferior products. If his crops are to be sold farther away than the next market village, the gravest problem is the cost of transportation. Because of poor roads and primitive methods of carrying goods, the expense of transporting wheat 50 miles is in some regions greater than the price the farmer gets for it. This problem has been made more serious by the *likin*, a tax imposed at various stations along the way. In 1930 the government issued a mandate abolishing the likin, but the ruling was only partially enforced. High taxation is another affliction. Chinese farmers have to pay taxes five or six times as high as farm taxes in the United States. Rent is another problem. Peasant tenants must pay landowners a third or even half the crop. When the Chinese Communists took over the nation in 1949 they promised to distribute the land to the peasants. But the change was slow. Both landowners and peasants resisted.

PLOWING A FLOODED FIELD

The stolid water buffalo is the chief work animal of the rice farmer. The plow, made entirely of wood except for the iron-edged share, is light enough for the farmer to carry.

The Tragedy of the Forests

China once had beautiful forests. Long ago, however, the people used up most of the trees, and now there is little wood for building and for fuel. In the heavily populated regions most of the land is bare, and only in the secluded yards of temples and monasteries are there wooded spots. Good forests are now found mostly in the high mountains of the northwest and in the low hills of the southeast, where pine, oak, camphor, and fir are the most abundant trees. Bamboo is grown in the Yangtze hills and elsewhere in the south and is used for many different purposes (*see* Bamboo).

The cutting of the forests has meant disaster for the farmers, because the forests prevented floods and kept the rain from washing good soil from the mountain sides and from carving gulleys in the farm land. In some regions the clay washed down from the mountains has spoiled the fields below and made whole valleys useless.

Improvements in Farming

We hear much today about changing China. China is changing, but it will be long before the mass of the farm people will change their ways greatly. Before the Japanese invasion in 1937 the government was trying to improve conditions for the farmer. It had developed seeds that yield larger crops and was promoting tree planting. The outstanding institution for the promotion of agriculture was the National Agricultural Research Bureau of the Ministry of Industries. The University of Nanking was foremost in training agricultural experts. Agriculture was also taught in many colleges and in secondary schools.

Transportation and Manufactures; Minerals and Trade

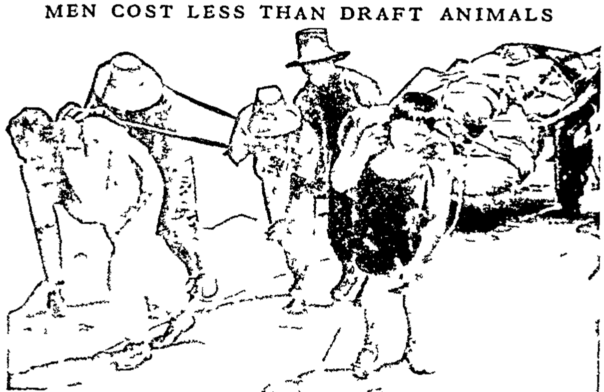
ONE IMPROVEMENT that will better conditions for the farmers is good transportation. China has about 14,000 miles of railroads and 80,000 miles of highway, with airlines linking the large cities. The rivers and the maze of canals which crisscross the plains are still the best routes of travel through much of the country. Along these waterways one sees junks with their picturesque sails and cargo rafts being rowed or poled or pulled by trackers along the bank.

The most famous waterway is the Grand Canal. This is the longest artificial waterway ever built. It was begun perhaps five centuries before our era. About A.D. 1280 it was deepened and extended to run from Hangchow, south of the Yangtze, to Tientsin, 850 miles north, for the purpose of bringing the tribute of rice from the Yangtze plain to the emperor at Peking.

Through most of China, goods are still carried over narrow trails and unpaved roads in oxcarts, on wheelbarrows, on donkeys, and more commonly, on the shoulders of men. Such methods are exceedingly costly, because the loads that can be carried are small and the distances that can be covered in a day are short. Human labor to carry loads and drive pack animals is so plentiful that China was slow to awaken to the need of better transportation.

China's first railway, ten miles long, was built in 1876 by foreigners. However, the common people, through fear that it would not please their gods, objected to it so violently that the government bought the road and abolished it. Thereafter there was almost no railroad construction in China until the end of the century.

MEN COST LESS THAN DRAFT ANIMALS



Even in the large cities most of China's freight is pushed or pulled or carried by men. This picture was taken in the heart of Shanghai.

China's manufacturing has been carried on for thousands of years by skilled craftsmen, who were organized into guilds like those of medieval Europe. Not until the 20th century did the Industrial Revolution and the machine age get well under way.

China Enters the Machine Age

The Yangtze Valley is the center of the new industrialism. Its warm, moist climate is particularly well suited to the largest industry, the manufacture of cotton goods. With more than 400 million people wearing cotton clothing, mills developed rapidly. In a few decades nearly 100 mills were built in the Yangtze Valley alone. Chinese owned about two thirds of the mills, Japanese nearly a third, and the rest were British. China now has about 230 cotton mills; but hand looms still produce large quantities of goods.

There was strong opposition to the introduction of modern machinery for the ancient silk industry, but silk filatures (mills for reeling silk) gradually increased in number. Wool and rayon goods, cement, chemicals, cigarettes, matches, glass and porcelain, egg albumen, sugar, and flour are other factory products. Small factories produce many articles that can be made with cheap and simple machinery, such as flashlights, soaps, perfumes, and canned goods.

Factory wages are very low and the hours long. The Nationalist government drafted factory laws and regulations, but they were little enforced. Men, women, and even children worked seven days a week and ten or twelve hours a day. Few precautions were taken for the workers' health and safety. The Communist government, aiming to industrialize China, called on the people to speed up production. The government increased the mechanization in factories and sent students into technical schools to learn modern methods. Hundreds of Russian technicians worked with the government program.

Minerals and Mining

China has immense deposits of coal, both bituminous and anthracite, and coal mining is the most important mineral industry. Although there is some coal in almost every province, much of it is not suitable for the manufacture of steel, and much is so deeply buried and so far from water transportation that mining is not practical at present. China proper normally produces about 20 million tons of coal a year and uses about 25 million.

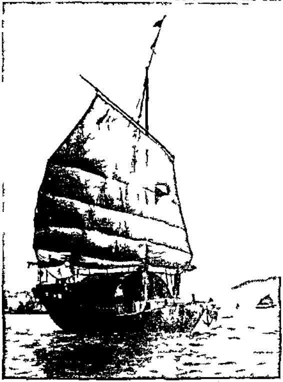
Iron reserves are widely distributed, with the richest mines in Manchuria. The ores of the southwest were the basis of the big expansion of the iron and steel industry during the second World War. New petroleum fields were opened in the northwest. Copper mining is an ancient industry, and China is a large consumer of silver.

There are three metals, however, in which China ranks high as a world producer—tin, antimony, and tungsten—all of them indispensable to modern industry (*see* Antimony; Tungsten). China normally produces most of the world's antimony and tungsten and an important share of the tin. Lead, zinc, and manganese are also mined. Pottery clays and building stone are plentiful. Other mineral products are alum, soda, salt, and gypsum.

China's Exports and Imports

Interesting to Americans is the fact that China is the first foreign nation with which the United States traded. By the time George Washington became

IN SUCH VESSELS THE CHINESE BRAVE THE SEA



Junks still carry much of China's ocean trade. Their style has not changed for centuries. They are flat bottomed with square ends and have eyes painted on the bow to ward off evil spirits

president 15 clipper ships had arrived in Canton with cargoes of ginseng (*see* Ginseng) rum tobacco molasses and furs On the return trip their holds were filled with tea silks spices cotton goods called nankeens fine porcelains and lacquer ware

The chief products that China sends to other nations today are tea eggs and egg products hides furs and skins raw silk tung oil embroideries and laces short-fiber cotton cotton yarn peanuts and peanut oil pig bristles and oil seeds It also ships a long list of other products including tin tungsten ore antimony musk (from the musk deer of Szechwan) and porcelains

Long staple cotton for the textile industry is a leading import because the Chinese cotton has short fibers Cotton piece goods are also imported Rice wheat flour and sugar are brought in to supplement the insufficient home-grown supplies The modernizing of China has created a large demand for iron and steel industrial machinery timber and materials for such projects as railroad building and telephone installation Petroleum products paper including newsprint chemicals and dyes and tobacco are other imports More than two-thirds of the foreign trade has normally been with the United States Great Britain Japan and Germany with the United States well in the lead

Confusion in Chinese Money

A handicap to trade has been lack of a uniform currency For centuries silver was the base for Chinese money but the Chinese themselves did not mint silver coins Their unit was the *tael* which is also a unit of weight the Chinese ounce Transactions were figured in taels of silver but the currency used was mostly foreign silver dollars especially Mexican dollars the American trade dollar or the old Japanese yen A 50-tael lump of silver called a *sycee-tael* was also used The weight of the tael varied from place to place so money dealings were extremely complicated Even after the Chinese provinces began in 1889 to coin their own dollars there was no uniformity

In 1933 the government adopted a standard silver dollar but the rising price of silver soon forced China off the silver standard During the civil war with the Communists Nationalist China suffered enormous inflation The Communists in 1949 circulated paper people's currency In 1950 they also established the silver yuan normally 45 cents in United States money But inflation was common

For small transactions copper coins called cash were used for 25 centuries They had a hole in the center so that they could be strung together These were replaced in 1900 with a 10-cash cent One hundred cents were supposed to be worth a dollar but the provinces flooded the country with cents 20-cash pieces and 50 cash pieces and they sank to a fraction of their supposed value In large cities they are no longer used but they are still popular in rural sections

A COOLIE GANG OPERATING A PILE DRIVER

Work is hard but the coolies are cheerful Their chant as they heave is one of the charms of China

AN OLD-FASHIONED MARRIAGE CEREMONY

The bride is borne in an enclosed chair to the bridegroom's home. The bridal pair are then conducted to the hall, where they prostrate themselves first before the ancestral tablets and then before the bride's parents. The picture shows the bride's mother placing a rose in her hair during this ceremony.

Social Life, Religion, and Education

Society is democratic, with no caste or class system. The family is the all-important social group. The Chinese is interested first in his family, and second in his village, but he is only remotely concerned with the nation and its problems. "Rulers may come and rulers may go, but Chinese families will remain Chinese families," says Lin Yu-t'ang. That is just what happened in the past. The civilization that the Chinese built has lasted through 4,000 years of political change and even through conquest by foreigners, because of the strong sense of loyalty to the family and the village.

The individual must put the interest of the family ahead of his personal interest. It is a young man's duty to marry and have sons to carry on the family. The sons commonly bring their wives to their father's homestead, which the father rules as long as he lives. His leadership passes to the eldest son. Old people are greatly respected, and when they die they take their places among the ancestors who are worshiped by their descendants.

Ancestor Worship and Religions

The lists of ancestors which have been found in ancient tombs are among the earliest records of Chinese history. These tell us that 1,700 years before our era the ruling families were worshiping their ancestors. Ancestor worship is the reason for a great deal of Chinese resistance to change.

Of the three chief religious systems, Taoism (*dow'izm*) is the oldest. This grew out of the teachings of Lao-Tse in the 6th century B.C. Lao-Tse taught a Way—the right way of life. One follows the Way by using Li, or right relationships, with everyone. Many superstitions which have nothing to do with the doctrines of Lao-Tse have crept into Taoism. Another belief is Confucianism, which is not so much a religion as a code of morals taught by the philosopher Confucius, or K'ung-fu-tse (*see* Confucius). It teaches right behavior toward family, friends, and government, and that the old is good and the new undesirable. A third religion is Buddhism, which came from India. It teaches transmigration of souls into other bodies and the worship of many gods (*see* Buddha). These religions are now confused and most people practice a mixture of all three. There are also many Mohammedans, especially in the northwest, and a number of Christians. Communist attacks on religion stirred resentment.

Education, Old and New

Throughout the long history of China scholars have always been highly respected. In the days of the empire only a small group was educated, but even the poorest youngster was given the chance to qualify for schooling. Then, if he passed examination for public office, he might have become an official (*mandarin*). And many officials amassed wealth by appropriating some of the taxes they collected—a custom called "squeeze." The exhausting literary examinations were abolished in the last days of the empire. The Nationalist republic in 1928 drew up more practical civil service quizzes.

Under the republic, children of means started to school at the age of six. The republic hoped to give education to every child. But when the Sino-Japanese War broke out in 1937, only 25 per cent of Chinese children were in school. After the Communists got control of China in 1949 they worked to close missionary schools. Of course, they filled public schools with propaganda but made little change in the school system. After six years in a primary school the pupil may enter a "middle school," a vocational school, or a normal school. From these he may go to a university or a college or a technical school. About a hundred universities and colleges with courses in the arts, sciences, law, education, agriculture, technology, commerce, and medicine had been established before war broke out in 1937. In 1952 the Communists shifted the emphasis in education to technology.

The revolution in education since 1900 has been one of the most

BURNING JOSS STICKS

The kneeling man is about to burn sticks of incense (joss sticks) before an image of Buddha.

striking features of China s changing civilization Formerly a Chinese scholar aimed at a knowledge of the Chinese classics of ethics and of Chinese history and government He also strove for skill in writing the h ghly artificial literary language Mathematics and the natural sciences had no place in the curriculum The lack of interest in these sciences which are the backbone of modern Western civil ization goes far to explain China s present difficulties The missionaries were among the first to bring Western education to Chinese youth Then large numbers of Chinese began to seek the new learning in Japanese and Western universities The returned students helped to establish the mod ern type of schools

MOTHER AND SON

He looks important and he is im portant for the dearest wish of the Chinese s for a male heir

Language and Writing

The Chinese spoken language is not in itself difficult, but the many dif ferent dialects create great confusion Each word has only one syllable Since there are only about 800 different syl lables in the language almost every word may have many different meanings These differ ences of meaning are indicated partly by combining words in pairs to convey a single idea and partly by speaking them in different tones That is why Chinese has such a singsong effect on our ears

The chief dialect is the official language *Kuan hua* which foreigners call Mandarin Subd alects of Mandarin are spoken all over north and west China Most of them are enough alike so that people through out this region can understand one another In the southeast dialects vary so widely that people in neighboring cities may be unable to understand one another

But though a man from Canton may not be able to nderstand a man from Peking they can write to each other for Chinese writing is the same everywhere It is a kind of picture writing and has no alphabet Each character stands for a word *not a letter (see Writing)* For in stance in the Nationalist s name of China at the right the four characters read from top to bottom *Chung* (Middle) *Hua* (Flowery) *Min* (Peo ple s) *Kuo* (Republic ')

中
華
民
國

To learn to write Chinese is much harder than to learn to speak it Scholars have to *know more than 40 000 charac*ters but only about 2 500 are needed for reading newspapers The popular education program called for a simpler method of writing Mandarin was adopted as the national language and taught in the schools Textbooks *used the old characters* but were based on the ordinary speech of the people Then James Yen founder of the Mass Education Movement devised a basic Chinese of 1 000 written characters in which peasants and coolies could learn to read and write

Three Thousand Years of Literature

THE LITERATURE of the Chinese is remarkable for its *great age Some historical* records and poems that still survive are believed to have been written as early as a thousand years before the birth of Christ In the enormous literature that has since grown up we find poetry history philos ophy collections of rites dictionaries encyclope dias biographical works gazetteers We find many works on agriculture and on medicine—two fel ls n which the Chinese had progressed long before Europe knew about scientific agriculture or medicine Until the Communist regime however there was little written on other natural sciences or mathematics

The Chinese prize most highly the ancient works known as the Confucian Canon—the Five Classics and

A FAVORITE ANCIENT SHADOW PLAY

Huan Tsang, a 7th-century Buddhist p lgrim carries the sacred manuscripts he has gathe ed on a journey to India He is followed by his wh te ho se and his companions Sun Wu k ung k ng of the monkeys Chu Pa tale with a pig s head and the monk Sha Wu tsing Shadow play figures a e made of parchment *co ored* and varnished They are operated behind a white gauze sc een

the Four Books. Three of the Classics are collections of ancient poems and other works said to have been collected by Confucius in the 6th century B.C.; and one he is said to have written. The Four Books are records of the lives and opinions of Confucius and his disciple Mencius. Chinese scholars know every line of these nine books by heart.

In poetry, Chinese literature is especially rich. There are old ballads and songs, odes of war and love, and verses about the sufferings of the people. Chinese poetry is delicate and suggestive, rather than forceful and sublime. It reflects, above all, pure delight in natural beauty.

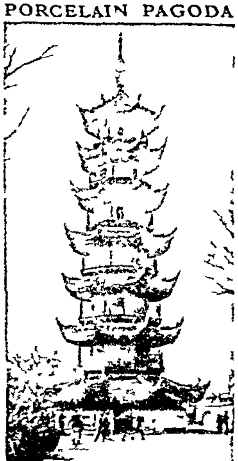
The novels are of particular interest for the insight they give into the life of the periods in which they were written. The first of them were written about 600 years ago. A famous historical romance is *San Kuo Chih*, 'History of the Three Kingdoms', which rose out of old tales somewhat like our Arthurian legends.

Until well into the 20th century all the writings that the Chinese thought worthy to be called "literature" were in the classical language. Only the writers of fiction used the everyday language—the vernacular. Today, as the result of a "literary revolution" in 1917 led by the great philosopher Dr. Hu Shih, the vernacular is used for every kind of writing. Books and publishing houses have multiplied. After the Communists seized China in 1949 all writing had to follow "party line" propaganda, glorifying the land, industry, and "democratic ideas."

Music and the Theater

Music has played an important part in Chinese life since ancient times. The old form of the drama is really opera Music is the soul of it and the acting is secondary. The audience has heard snatches of it from the cradle up and makes no pretense of following details of the unfolding story. When a climax is reached, and the actor pours forth his soul in a familiar song, the hearers applaud or hum in accompaniment, tapping the tempo with their feet or with folded fans. Then they slump again into half-attention, drinking tea, cracking watermelon seeds, and conversing, while attendants circulate with hot wet towels on which the spectators wipe their hands and faces.

PORCELAIN PAGODA



All pagodas have an odd number of stories, because odd numbers are lucky.

The old Chinese theater has little scenery, although costumes are elaborate. If an actor stoops, he shows that he is going through a door. If he carries a wand tipped with white horsehair, he is a supernatural being. If he carries banners with wheels painted on them, he is riding in a chariot. Stagehands walk about quietly changing chairs and tables while the play goes on.

Under Western influence new forms of drama are developing, and plays are given in the modern manner. In the newer playhouses the seats are like those in our own theaters, but on the back of each seat is a shelf for serving tea. Motion pictures from other lands as well as those from native studios, share the popularity of the old-time puppet shows.

Architecture, Painting, and Other Arts

IN SPITE OF its poverty and dirt, its yellow brown dust and its bare hillsides, China abounds in strikingly grand and beautiful scenes. No people appreciate natural beauty more keenly than do the Chinese. Their painting, their poetry, the decorations on their fragile porcelain vases, their textiles, even their architecture, reflect their love and reverence for the beauty of earth and sky, of birds and flowers and trees.

Architecture That Fits the Landscape

China would lose much of its charm without the gay pavilions that cling to the hillsides, the many-storied pagodas with little bells tinkling on their uptilted eaves, the high-arched stone bridges, and the tiny wayside shrines.

To decide upon the site of an important building or a tomb is no small matter, for it must be put up according to the laws of *feng-shui*, which means "wind and water." The forces of earth and sky, wind and water, must be favorable, and diviners are called in to find the luckiest location. An ideal site is protected on the north and is open on the south, so that the door can face in the latter direction.

Thus religious ideas, appreciation of nature, and the feeling that buildings should be in harmony with the landscape rather than dominate it, have always governed Chinese architecture. For centuries all Chinese buildings of the better class have been built on the same general plan. They stand on platforms or terraces of pounded earth, which are faced with brick or stone to form the floor. The terraces extend beyond the building on all sides, and in important structures are often built high, with a dozen steps or more, and are decorated with stone balustrades and sculptures.

Whether the walls are of brick or of wood, the framework usually is entirely of wood. Wooden pillars support wooden beams, on which rests the tiled roof with its uptilted eaves and grotesque little clay figures perched on eaves and ridgepole. One row of pillars across the front, or sometimes completely around the building, is left without walls to form an open portico or gallery. The central portion may be raised to form a second story, and a lean-to roof covers the lower portion.

The pillars and the side walls are usually painted vermilion. Pillars and beams may be carved, or they may be painted with elaborate designs in bright colors. The roofs have alternate convex and concave tiles.

These are gray for ordinary buildings yellow for imperial palaces and blue or green for other special buildings Temples pagodas and pavilions often vary from the usual rectangular shape The pagoda came to China with Buddhism but its style soon became distinctively Chinese Temples palaces and even private dwellings are generally enclosed within high walls China is a land of walls Every city and village has its ramparts primarily for defense City walls are usually of clay or earth faced with brick The gates topped by watchtowers are usually opened at sunrise and closed at nightfall China s oldest architectural monument is the Great Wall along the north and northwest boundary Much of this was originally built by the powerful Emperor Shih Huang ti in the 3d century B C to keep out Tatar invaders

Nature Rules Painting

Love of landscape beauty has dominated Chinese painting as it has their building Human figures are only part of the natural scene as depicted by the artist Many paintings are on long strips of silk or paper and are kept in rolls to be unrolled and enjoyed *bit by bit There are also pictures* to be hung on the wall paintings on screens and small paintings mounted in albums Some of the finest paintings were frescoes on the walls of temples but most of these have been destroyed More than 300 Buddhist *frescoes it is said were painted by* Wu Tao-tzu China s greatest painter who lived early in the 8th century

Painting grew out of writing or calligraphy By the time a student had learned to make the elaborate word-signs with fluency and *rhythm he was an expert with the* brush for the Chinese write with a brush not with a pen Their ink is made of soot glue and oil dried in the form of a brick or stick When it is moistened with water it is like paint and the blackest black or the faintest gray with all shades in between can be produced Some of the best painters have worked only with these different shades of ink When color is used water colors are applied usually to an ink foundation or outline

A Chinese artist never copies a landscape exactly He observes carefully and his picture is complete in his mind before he begins his swift sure strokes which cannot be corrected His painting is an impression—an effort to convey the spirit of the scene He never represents shadows and he suggests perspective only by range of tone

PAINTING ON SILK

In this painting of the late 17th century we see the three leaders who most deeply influenced Chinese religion and philosophy Old Philosopher Lao Tse is presenting the child Confucius to Buddha

Critics tell us that Chinese painting is among the greatest in the world Unfortunately few works of the best masters have been preserved Some of the *finest are in American museums*

Sculpture a Minor Art

The Chinese do not appreciate sculpture as they do painting Their best works are animal sculptures most of which were made in honor of the dead and have been found in ancient tombs In 1934–35 archeologists *found pieces of perfectly proportioned white marble animal figures in tombs more than 3 000 years old Most of the figure sculpture is religious After Buddhism* reached China early in the Christian Era sculptors made many religious figures first in bronze and stone later in wood They were more interested however in showing the folding and pleating of the flowing garments *than in modeling the natural lines* of the body or making the faces lifelike By the 10th century when Buddhist sculpture was at its best figures and faces were more natural After the Sung period (900–1279) religious sculpture declined and sculptors gave their best efforts to the decoration of columns balustrades and other architectural features

Pottery and Porcelain

One of the debts the world owes the Chinese is their invention of porcelain We recognize this by calling our porcelain dishes china or chinaware The potter s wheel was in use 4 000 or more years ago but China s ancient *pottery could not compare* in beauty with that of the Greeks Glazed ware appeared during the Han Dynasty (*206* B C *220* A D) and from that time on wares of extraordinary beauty were produced Porcelain was made some *time before the 9th century of the Christian Era* Each period had famous potteries state and private and different centers became noted for their particular wares They made fine porcelains for emperors and nobles *heavy stoneware vessels for daily use funeral* objects to be left for the dead in tombs and roof tiles (*See* Pottery and Porcelain)

Metal Work and Other Arts

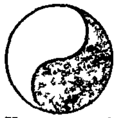
Although it took many centuries to bring China s pottery art to its best the castings of its Bronze Age have not been surpassed in later times or in other countries The bronze ritual vessels which archeologists have found in tombs 3 500 years old are supremely beautiful The designs on them are conventionalized forms of animals such as the dragon the cicada the

water buffalo. They combine large and bold design with delicate tracery. The Chinese have always prized their bronze work and have continued it through the ages; but the bronzes of the past thousand years cannot compare with those of ancient times.

The Chinese also worked in iron and silver and pewter, and to some extent in gold. They excelled in enamel work (*see* Enameling) and in carving ivory and jade. The Chinese prize jade as we prize diamonds and emeralds, and no other people have approached them in the art of carving this tough stone into forms of exquisite beauty. Lacquerwork is another ancient art. Over a wood or metal or papier-mâché base the artist applies several coats of lacquer (*see* Lacquer), colored scarlet with cinnabar or yellow with gamboge, or black or brown or green. On the lacquered surface he paints, carves, or molds his decoration, perhaps enriching his work with an inlay of mother-of-pearl.

The Chinese also brought the weaving of silk and other textiles to a fine art. They made velvets and satins, and rich brocades interwoven with gold threads. Into their silks they wove exquisite designs of flowers and birds, of landscapes and scenes from life and from their legends. The beautiful silks from Chinese looms were one of the luxuries brought to wealthy Romans by the long caravan routes across Asia.

History of the World's Oldest Living Nation



Yang and Yin make the circle of the whole.

THE CHINESE story of creation says that at first all was confusion. Out of this chaos came two forces, *Yin* and *Yang* (*Yin-Yang*), which together make the circle of the whole, or everything. Yang was bright, warm, active, masculine. Yin was dark, cold, still, feminine. The symbol of these two forces—a circle divided into curved halves, one white, one black—is much used as a decorative element.

Yang and Yin after many ages brought forth a mighty man called P'an Ku. He became the earth, and he created the sun and moon and stars. P'an Ku grew and changed until his head became the mountains, his breath the clouds, his voice thunder, his veins rivers, his skin and hair the great trees, his teeth and bones the metals hidden in the earth, his sweat the rain. The insects that crawled over him became the people. A dragon, a phoenix, and a tortoise helped P'an Ku in his work.

The dragon has a prominent place in Chinese mythology and is supposed to have wonderful powers. It came to stand as a symbol of the empire, so that the throne was known as the "dragon throne." Until the time of the Revolution in 1911 the Chinese flag was a great black dragon in a yellow field.

The Chinese say that they are made up of five different peoples. The first flag adopted after the Revolution was made up of five broad stripes—red for Chins, or Chinese, yellow for Manchus, blue for Mongols, white for Turks, black for Tibetans.

Records of Ancient China

Whatever the origin of the people, we know that one of the world's early civilizations flourished far inland on the North China Plain. Archaeologists can trace this civilization back perhaps 3,500 years from relics left by a people who had already developed agriculture and the arts and a system of government. How much earlier it began, we do not know; but, since the discovery of the "Peking Man" in 1929, we have reason to believe that China was inhabited as early as any other part of the world (*see* Man).

The political history of China is the story of the rise and fall of dynasties, or ruling houses. Periods of foreign invasion and civil strife alternated with long periods of peace, prosperity, and cultural brilliance. Armies were often on the march. China's boundaries widened, narrowed, and widened again.

Tradition puts the founding of the first of the dynasties, the Hsia (*shē'ä*), at about 2200 B.C., but the accounts of the early rulers and their achievements were all written many centuries later and are regarded as legends rather than history. The earliest written records are the "oracle bones" from the period of the *Shang Dynasty* (about 1700–1100 B.C.). On the bones of oxen or the shells of tortoises the people wrote questions asking their gods for advice. Diviners heated the bones until cracks appeared and then decided from the cracks what the answers should be. Scholars have recently succeeded in reading these oracles and have obtained a great deal of information about Chinese life in prehistoric times.

With the *Chou Dynasty* (about 1100–250 B.C.), we begin to have more trustworthy information. This long period of eight or nine centuries was the Feudal Age of China. The land was owned by the nobles and by the rulers of the many smaller states who owed allegiance to the Chou kings. As in medieval Europe, the peasants who tilled the land were serfs. After the 6th century there was a remarkable development in art and culture. This was also the period of the great philosophers and religious leaders, Confucius, Lao-Tse, Mencius, and Mo-Ti.

Rise of the Empire

About 250 years before the Christian Era, the state of Ch'in, or Ts'in, overthrew the Chous. Its founder Shih Huang-ti, unified the country, swept away the powers of the feudal lords, and permitted the sale of land. He built roads, extended irrigation works, and constructed a long stretch of the Great Wall. The memory of him, however, is not entirely happy, for he burned the revered Classics of Confucius because he thought the people were turning too much to the past and were criticizing his reforms. His brief dynasty, the *Ch'in* (249–207 B.C.), perhaps gave us the modern name China.

Some of the Great Dynasties

Among the great epochs was that of the *Han Dynasty* (206 B.C.–A.D. 220), which made China, next to Rome the most powerful state of the time. The boundaries

were extended far to the west and south In this period the Chinese learned to make paper from the bark of the mulberry tree hemp and rags—a thousand years before this art reached Europe The T ang was another brilliant age (A D 618–907) in which the *first block printing seems to have been done* During the *Sung Dynasty* (A D 960–1279) books multiplied and some of the finest porcelains and paint ngs were produced The Sungs were probably the first to use gunpowder for warfare although the Chinese had used it earlier for fireworks

Early Contacts with the West

During the Han rule the caravan routes to the west became great highways of trade By the 8th century Persians and Arabs and merchants from India were coming to Canton by water Merchants brought glass jade precious stones ivory and fine woolen and linen *goods* They *carried away silks and furs spices* and fine porcelains and the seeds of the peach or ange and apricot to introduce these Chinese fruits to the west

Buddhist monks and pilgrims from India had for centuries been working their way overland to China and *Chinese Buddhists had traveled to India* br ng ing back new ideas in architecture and other arts Moslems came in by land and by sea Foreign inva-s ons brought new ideas and new products but the Chinese gave far more to fore gn peoples than they received Neighboring peoples to the east and south were especially *influenced* Japan for example cop ed Ch nese forms of art and arch tecture and writing

Mongol Rule and Marco Polo

Even the destructive Mongols who in the 13th cen tury swept over Asia and set up the largest empire the world has ever known adopted China s culture When they conquered China Kublai Khan founded the *Yuan Dynasty* (1280–1367) and bu lt h s cap-ital Cambaluc where Peking now stands Under Mongol rule traders and travelers flocked in The most celebrated of these travelers was Marco Polo who upon his return home astonished Europeans with his tales of Cathay as he called China (*See also* Mongols Polo Marco)

The Mings Overthrow the Mongols

Mongol rule lasted a little less than a century It was overthrown by a native leader who established the *Ming Dynasty* (1368–1644) This was the last native dynasty The name Ming means bright or glorious and in its best years *this was a great age* The empire expanded populat on increased and order was maintained The arts flourished and a magnificent royal city was built at Peking But the people now heartily tired of foreign rulers and inva-s ons no longer welcomed foreigners Trade by sea was still active but the caravan *routes to the west* were blocked because the nation s declining military power could not keep the barbarian tribes in check

Manchus Bring China Again Under Foreign Rule

Meanwhile a new power was ri ng in the northeast —the Manchus (*see* Manchuria) By the middle of the *17th century (1644) they had* conquered China Again fore gners sat on the dragon throne The rule of the Manchus—they called themselves the *Ch ing* (pure) *Dynasty*—lasted until China became a republic in 1912 In the first part of their reign the Chinese Emp re reached its greatest extent It included the outlying dependencies of Manchuria Mongolia Sinkiang (Chinese Turkestan) and Tibet and it rece ved tribute from a number of neighboring states —Indo-China Burma Siam Korea and others The chief interest of th s age lies in its last three-quarters of a century when China s culture began to change *as it had never changed before* as a result of the coming of Europeans

The Coming of the Europeans

The Portuguese were the first Europeans to come knocking at China s door in the 16th century (*see* Portugal) The Ch nese d d not welcome them but al *lowed them to sett e at Macao near the mouth of the* Canton River By the beginning of the 19th century Dutch French Engl sh and finally American traders had made their way to Macao and Canton Miss on aries too were allowed to settle in several cities

Foreign trade was subject to severe restr ctions and *many taxes* It *was restricted to Canton* and all dealings had to be with a guild of Chinese merchants called the *Co-hong* The Chinese looked upon other nat ons as inferior and called foreigners barbarians and fore gn devils The emperor made foreign en voys *koutow* or prostrate themselves before him European nations resented this treatment but not to the extent of giving up trade The West was expand ing and becoming prosperous as a result of the begin nings of the Industrial Revolution and Western peoples wanted China s silk tea and chinaware and they wanted to find new markets for their own products So there was bound to be trouble

The Opium War

The traffic in op um brought about a cris s Opium smoking in China had become a nat onal problem (*see* Opium) The government forbade its importa t on but the Canton officials allowed the trade to continue Suddenly the emperor sent a commis-s oner to end the trade British traders were im prisoned and the r stocks of opium were destroyed The so-called Opium War (1839–1842) followed ending in humiliating defeat for the Chinese They were forced by the Treaty of Nanking to open five ports called treaty ports for res dence and trade *to cede the island of Hong Kong to Great Br tain* to establ sh a fair tariff and abol sh the Co-hong and to pay a large indemnity

Trying Days for China

Treaties with the United States and France in 1844 provided extraterritoriality and other concessions Friction however continued In a second war 1856–60 China was again defeated by Br tain with France as an ally In the Treat es of Tientsin China was *forced* to admit foreign diplomats to Peking to tolerate Christianity and to make other concessions

In time there came to be 69 treaty ports where for eigners might own property and conduct business In

certain of the treaty ports, "concessions" of territory were given to European countries in which their nationals might lease land. Foreign "settlements" were also established, notably at Shanghai, with the land under perpetual lease. Communities of foreigners gained the right of "extraterritoriality," or the right to be governed in many important matters by their own laws and officials rather than by Chinese. Foreign powers were also permitted to administer the Customs Service and to maintain gunboats on the rivers and small garrisons of troops to protect their people.

As the ring of foreign nations closed about China, they pressed home every opportunity to obtain other advantages. The slightest clash became a pretext for further humiliating the Chinese and demanding new privileges. In these aggressions the United States took no active part, but it insisted on sharing in the trade privileges thus obtained. All trade treaties contained a "most favored nation" clause, so that any advantage obtained by one nation applied to the other nations as well.

The Coming of the Missionaries

Christian missionaries, as well as the traders, played an important part in bringing Western influence to China. Nestorian priests from Syria made their way into China in the 7th century, according to ancient records, and they apparently had some little influence in the two centuries that followed. Before the end of the Ming Dynasty, Catholic missionaries—Jesuits, Franciscans, and Dominicans—had made some headway in spite of periodic persecutions. In the 17th century a Jesuit, Johann Adam Schall, was appointed by a Ming emperor to correct the Chinese calendar.

The first Protestant missionary, Robert Morrison, was sent out by the London Missionary Society. He arrived in 1807 but was not permitted to go beyond Canton. There he devoted himself to learning Chinese, preparing a dictionary, translating the Bible, and writing tracts.

After the Treaty of Nanking opened the treaty ports and the Treaties of Tientsin guaranteed protection to the missionaries and their converts, missionary work expanded rapidly. The missionaries' path was not a rosy one, however, for they were often misunderstood, and the Chinese feared the effect of their teachings on China's traditional institutions. Their work therefore continued throughout the century to lead to numerous riots and persecutions.

The missionaries founded the first schools on Western lines. They worked for greater freedom for women and succeeded in establishing schools for girls. They introduced public health measures, founded hospitals, and were the creators of the modern medical profession in China. They founded a number of universities and colleges, notably the University of Shanghai. Many of China's leaders and professional men and women were trained in mission schools and colleges. Thus, though the missionaries—Protestant and Catholic—converted less than one per cent of the people, they had wide influence in changing China.

One amazing result of Chinese contact with the West was the Taiping Rebellion (1848–65). This was inspired by a fanatic dazed by his strange interpretation of Christian teachings. Taiping, meaning "great peace," was to be the name of the new dynasty which the rebels hoped to establish. But before the revolt was over, the "great peace" of death had descended upon 20,000,000 Chinese citizens and had laid waste many of the fairest provinces. For a time the picturesque British officer known as "Chinese" Gordon aided in crushing the rebellion (*see* Gordon, Charles George).

Foreign Domination Grows

The period from 1865 to 1894 was relatively peaceful, although foreign pressure was constantly tightening. In 1894–95, however, China fought a disastrous war with Japan, and was forced to recognize the independence of Korea, which had long paid her tribute. She had to give Japan the island of Formosa (Taiwan), the Pescadores Islands, and the Liaotung peninsula of southern Manchuria; but Russia, France, and Germany at once forced Japan to give back Liaotung.

This defeat was a signal for European countries to scramble for more Chinese territory. Great Britain, Germany, France, and Russia obtained leases of districts on the coast of China. Kiaochow Bay and Tsingtao in Shantung went to Germany; Port Arthur and Dalny (Dairen) on the Liaotung peninsula, to Russia; Weihaiwei and the peninsula of Kowloon to Great Britain; the Bay of Kwangchow to France. These countries also demanded "spheres of interest"; that is, concessions to open mines and to build railroads. They also acquired rights to lend funds to the Chinese government. The debts thus incurred gave them a stronger hold on China.

The Open-Door Policy

It now looked as if the richest part of China would soon be carved up and divided among the nations. Great Britain and the United States were alarmed at this threat to their trade and wished to establish an "open-door policy"; that is, to keep all of China accessible to the trade of all nations. John Hay, United States secretary of state, in 1899 sent notes to the European powers suggesting that in the leased territories and spheres of influence the same tariffs, harbor dues, and railroad charges should apply to all nations. The nations assented.

Beginnings of the Reform Movement

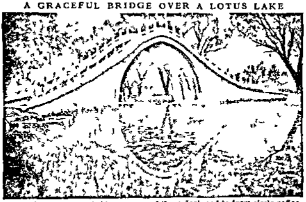
But the real effort to save the country had to come from the Chinese themselves. The clash with Western ways had deeply disturbed them. They saw that the foreign concessions and settlements were oases of cleanliness, order, and safety. Even many Chinese had moved into the foreign sections of the cities to profit by Western ways of government, though they had a brooding hate of the white race for its arrogant treatment of them.

The war with Japan, moreover, had shown what could be done by an Oriental nation which had adopted Western ways. Clubs in favor of reform sprang up.

One of the leaders in the reform movement was Sun Yat-sen, who had received a Western education and had been active among Chinese abroad trying to get their support in overthrowing the Manchus and establishing a republic

The demand for change was felt in the slumberous depths of the Manchu palace, and in the summer of 1898 the air was thick with edicts intended to modernize China They were the work of the young Emperor Kuang Hsu (*kuäng shü*) and his radical advisers But he reckoned without his aunt, the wily Dowager Empress Tzu-hsi (*tzü she*) Working like a spider in the dark web of Chinese politics, Tzu hsi held in her masterful hands the real power Suddenly she struck She dethroned and imprisoned the young emperor, executed many reformers, and abolished all reforms.

A GRACEFUL BRIDGE OVER A LOTUS LAKE



Everywhere one sees bridges many of them designed to form circle reflections like this camel back bridge in the Summer Palace grounds near Peiping

Boxer Rebellion and War with Japan

Sweeping up like a storm after the lightning flash of the Empress' bold stroke, fanatical bands of "Boxers" pledged themselves to oust the foreigner "Boxer" was a name given by Westerners to an organization of secret societies that called themselves *I Ho Ch'uan*—"Patriotic Union of Fists" In 1900 the Empress issued the startling order that all foreigners should be killed A reign of terror followed Hundreds of missionaries and native Christians were slain Boxers and Imperial troops *besieged the foreign legations in Peking* for two months Finally an allied force of foreign troops forced their way to Peking Eager for revenge, many of them joined in looting the palaces The powers dictated severe terms The Taku forts guarding the approach to Peking from the sea were razed and a heavy indemnity was imposed The United States in 1908 returned some of its share of the indemnity to be used for Chinese education and later other nations followed its example

While this humiliation still rankled Japan went to war with Russia (1904) and defeated the "Great Bear" China's territory of Manchuria was the chief battlefield, and both Russia and Japan had a firm foothold in the region at its close Moreover, the peace treaty recognized Japan's special rights in Korea (Chosen), and transferred the Liaotung peninsula to Japan

China Becomes a Republic

The war vastly increased Japan's power in China. The Chinese were impressed because an Oriental nation, by adopting Western ways had beaten a world power Demands for change arose in China In 1908 the empress died She was succeeded by a three-year-old baby Hsuan-tung who later became Emperor Kang-teh of Manchukuo People demonstrated against the inept Manchu reign On Oct 10 1911 troops in Wuchang mutinied Whole provinces revolted against the Manchus On Feb 12 1912 they abdicated and China was proclaimed a republic with Dr Sun Yat-sen as provisional president To win northern support, he resigned in favor of General Yuan Shih kai

The Kuomintang or Nationalist party, which had been organized by Sun Yat-sen, was suspicious of this strong viceroy of *the old monarchy* When he adopted high handed methods in establishing the government, the Kuomintang revolted in 1913 Yuan crushed the revolt and made himself a military dictator By 1915 he was dreaming of making himself emperor Widespread opposition balked this plan and in 1916 Yuan died, presumably by his own hand

Yuan had been more successful in opposing Japan than in uniting his country In 1915, when the European powers were busy fighting Japan presented the notorious "Twenty-one Demands" These were in effect pistol-at-the-head *demands for the political and economic control of China* The vigorous disapproval expressed in England and the United States encouraged Yuan Shih kai to resistance, and the demands as he accepted them were greatly modified They did however, strengthen Japan's hold and brought down upon her China's bitter hatred

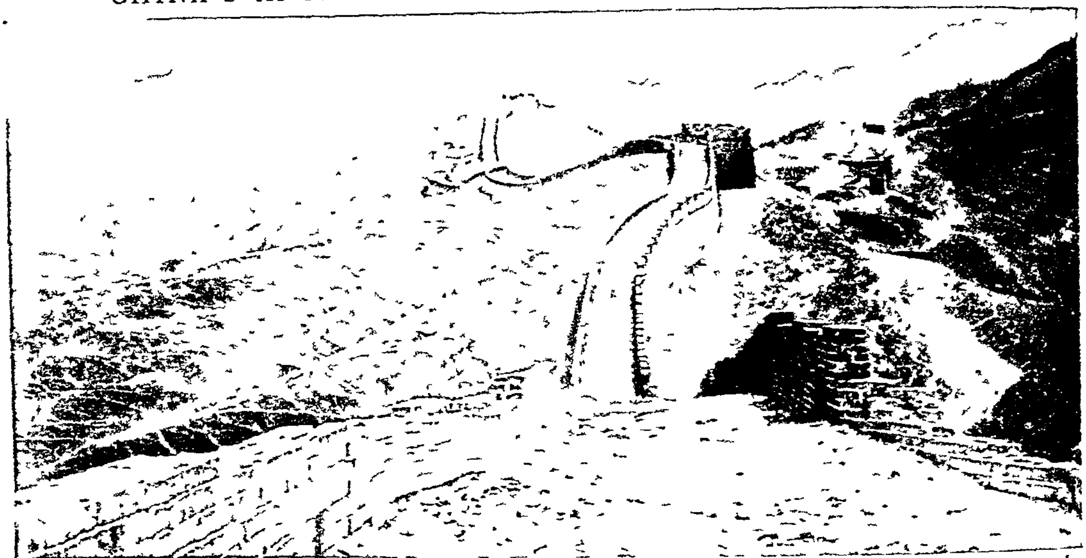
China and the First World War

In 1917 China entered the World War against the Central Powers It contributed little except by sending to Europe labor battalions of coolies The Chinese delegation at the Versailles Peace Conference likewise obtained little They asked for cancellation of virtually *all foreign privileges in China*, and for the return of the former German properties in Shantung, which Japan had seized (*see* Shantung) The United States supported the Chinese claims in Shantung, but Japan won because of a secret treaty it had made in 1917 with Great Britain, France, and Italy In their indignation, the Chinese declared a boycott of Japanese goods China refused to sign the Treaty of Versailles and worked out a separate treaty with Germany.

Improvement in Foreign Relations

From the close of the first World War until 1931 China freed itself considerably from foreign control. At the Washington Conference of 1921-22, nine

CHINA'S ANCIENT BARRIER AGAINST THE BARBARIANS



Winding for 1,500 miles over mountain and plain, the Great Wall of China is a reminder of the country's long struggle to keep out invaders from the north. Much of it was built in the third century B C. It has since been frequently repaired and extended. Its height varies from 15 to 50 feet, and its width from 15 or 25 feet at the base to 12 feet or more at the top.

powers, including Japan, signed a "hands off" agreement—the Nine-Power Treaty—and Japan gave up her interests in Shantung. In 1929 China resumed the privilege of fixing its own tariff, which foreign nations had kept absurdly low. The government announced that extraterritoriality would be abolished, but internal troubles and difficulties with Japan prevented it from making this announcement effective. Soviet Russia relinquished many privileges, but clung to the Chinese Eastern Railway which it had built in Manchuria. Other countries, notably Great Britain, appeared willing to give up many of their special privileges as soon as the Chinese should be able to maintain order and justice themselves.

Confusion and War Lords

But China was in turmoil. The Kuomintang had set up a separate government at Canton with Sun Yat-sen as president, and the Peking government was becoming weaker. Squabbling *tuchuns*, or war lords, fought for control of various provinces. With the old political institutions being scrapped and the new machinery not yet worked out, with changes going on which affected every phase of the nation's life, with provinces and generals warring against one another, millions of people lost all means of getting a livelihood. Many took to banditry, as Chinese had done for ages past in times of distress.

Sun Yat-sen and the Kuomintang made little headway in gaining control. In 1925 Dr. Sun went to Peking to confer with the war lords Chang Tso-lin and Feng Yu-hsiang, who were organizing another provisional government, and there he died.

His death, however, did as much for his party as had his life. His little book *San Min Chu I*, or the 'Three People's Principles', gave new enthusiasm and a definite program to the Kuomintang. The people had trusted Sun Yat-sen in life and they worshiped him in death. Reverently each week children in Chinese schools recited his three principles—government by the people and for the people, a sufficient livelihood for all, and freedom from the control of foreign nations.

The Communists and Chiang Kai-shek

Some months before he died, Sun had called in Russian advisers, saying he had not got help from other powers to overthrow the war-lord government in Peking. The Russians drilled Chinese army officers in modern warfare. Dr. Sun grew to oppose Communism but, after he died, Madame Sun became a leader in the expanding Chinese Communist movement.

The Chinese Communist party had been established in 1920–21. At first, it did not openly oppose the Kuomintang; instead, the Communists held membership in the Kuomintang and worked secretly toward the day when they could get control of it. In 1927 Russia set up the Sun Yat-sen University in Moscow to train Chinese students for Communist work in China.

As chief of the Kuomintang army, Chiang Kai-shek became China's "strong man." In 1926 he led his troops north, aiming to seize Peking. He took Nanking in 1927, and halted to "clean house" in the Kuomintang. The undercover Communist members had grown increasingly open in their scheme to wreck the party and had planned their own government for China.

In the name of the Kuomintang, the Communists had formed labor and peasant unions, incited riots, confiscated property, and seized control of central China. Their indoctrinated young followers cried, "Down with foreigners! Down with the Christian religion! Down with the teachings of Confucius!"

Chiang suddenly purged Communists from the Kuomintang, executed many leaders, and expelled the Ru-

s an advisers The Communists who escaped however controlled large armed forces and dominated several provinces They warred intermittently on Chiang

After Chiang took Peking which he renamed Pei ping or Northern Peace in 1928 his Nationalist government nominally held the whole country But strife continued not only with the Communists but with war lords who outwardly supported the govern ment but continued to rule some provinces like princes

Japan Seizes Manchuria

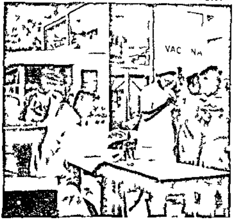
The young republic faced a far greater danger at the hands of its powerful neigh bor Japan which had deter mined to obtain in China raw materials and markets for its industries Japanese militarists looked upon the conquest of this vast country as the first step in their domination of the Far East They started in Manchuria where they had firmly entrenched them selves with railways mines and industries following their victory over Russia in 1905 When Chiang took steps to extend his authority into this region he came into conflict with the aims of Japan In 1931-32 Japanese armies seized Manchuria and set up the puppet state of Manchukuo (*see* Manchuria)

In 1933 Japan added Jehol a north China province to Manchukuo and marched its army south almost to the gates of Peiping China was forced to sign a truce by which a demilitarized zone was established south of the Great Wall By the end of 1936 Japan had extended its influence into Inner Mongolia and was seeking to separate north China from Chiang s Nationalist government in Nanking

Undeclared War Begins in 1937

The crisis came on July 7 1937 Using a minor incident as an excuse the Japanese fired the first shots in an undeclared war at the ancient Marco Polo bridge outside Peiping They poured troops into north China and also struck at the Shanghai region—the economic heart of the republic Heretofore Chiang had felt that China was too weak to offer more than passive resistance but now war could no longer be avoided The Chinese united as never before under Chiang s leadership and fought a bloody and destructive delaying campaign By the end of 1937 the Japanese were in control of a vast region in the north In central China they had pushed the Chinese back beyond Nanking and had captured territory as far south as Hangchow With these gains and a naval blockade of the coast the Japanese controlled the chief arteries of foreign trade with the exception of Canton But they had come to realize that their hope for a quick victory was vain

A VACCINATION CREW AT WORK



Modern health measures for those who can be reached after a flood help to check disease These school children are being vaccinated against cholera by Chinese medical workers who travel with a hospital bus

In the spring of 1938 the Japanese fought their way inland to seize leading railway lines Their chief set-back came when the Chinese cut the dikes of the Yellow River and let great floods pour through the breaches Japan s highly mechanized forces bogged down in the inundated country

China s greatest industrial center the triple city group of Hankow Hanyang and Wuchang fell on October 25 Three days earlier the Japanese had taken Canton in a quick advance from the coast Pursuing their scorched earth policy the retreating Chinese blew up bridges and factories after evacuating as many of the inhabitants as possible

The strategy of the Chinese after the first few months was to avoid pitched battles against forces better trained and better equipped and to keep up constant guerrilla warfare Japan won vast areas but after each gain more troops were needed for garrison duty and for guarding lines of communication They were able to hold only the ports provincial centers and railway lines In the enormous blocks of country between the railroads roving bands of guerrilla troops carried on their work of destruction and played havoc with Japanese communications

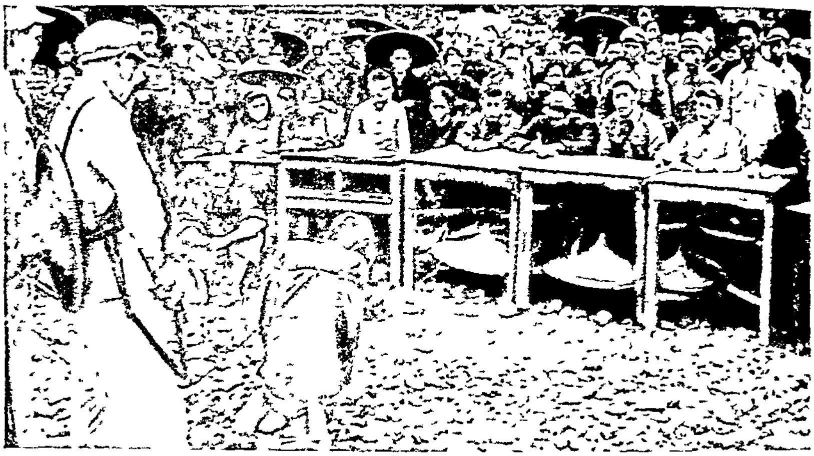
The National government had fallen back to Hankow first and then to Chungking up the Yangtze river in Szechwan province With it went a throng of refugees and many of the industrial and cultural institutions of the eastern cities Factory equipment was freighted up the Yangtze on river boats or carried overland on the backs of sweating coolies The old city of Chengtu became an educational center where colleges and universities held classes in temporary quarters for students who had made their way through enemy lines to enroll

Japanese control of ports and railway lines cut off China from foreign trade Anticipating this the Chinese had begun to improve communications to the west They built the famous Burma Road from Kunming across the mountains to connect with a railway at Lashio and improved the ancient caravan routes through Sinkiang to provide a highway into Soviet Russia But these routes were inadequate to supply the hard pressed Chinese armies so the government encouraged the building of factories and the development of mineral resources in free territory aiming to create its own war industry

China Joins the United Nations

With Japan s attack on American and British territory in the Pacific in December 1941 the Sino-Japa-

FIRST DICTATOR OF COMMUNIST CHINA AND SOME OF HIS WORK

At top is Gen. Mao Tse-tung, founder of the Chinese Communist party, who became head of Red China in 1949. At right, "people's court" sentences to death a "despotic landlord" who tried to cling to his two thirds of an acre. Mao's land distribution was ruthless.

nese conflict became part of the second World War. China joined the United Nations and Chiang Kai-shek became Allied commander in Asia, with Lieut. Gen. Joseph Stilwell, U. S. A., as chief of staff.

China remained virtually isolated. The Burma Road, last link to the sea, fell in 1942. Then only air-borne supplies, flown from India over the Himalayan "Hump," reached China until 1945, when Allied engineers built the Stilwell Road from Ledo and a pipeline from Calcutta. American-trained Chinese troops recaptured the Burma Road in 1945 and won Foochow. Chinese military action was chiefly a holding operation which kept several Japanese divisions from action elsewhere. Throughout the war the American Air Force, based in China, bombed Japanese-held cities. (*See also* World War, Second.)

China's courageous stand won it international prestige. Chinese delegates attended Allied councils. In 1943 the United States and Britain gave up extraterritorial rights in China, and the United States repealed its "Chinese exclusion" law (*see* Immigration). The United States also granted large credits and sent political and economic advisers.

Economic and Social Progress

Despite the war Nationalist China made some social and economic advances. Chiang and Madame Chiang Kai-shek organized a government program called the New Life movement, which included mass education. The New Life movement pushed health programs and efforts to improve stock breeds and seed selection. Co-operatives were organized to help the farmers sell their produce and buy supplies. Rural credit associations lent money to the peasant without the excessive interest rates that had kept him burdened with debt. New experimental *hsein*, or county, governments were set up to provide such welfare services as public health, education, and agricultural improvements. A National College of Rural Reconstruction trained workers to carry out these activities.

Mining and manufacturing were established in Free China. Part of the plan to fit modern industries into Chinese life was to use village industries to let farmers work in their slack time and still cultivate their ancestral acres. The government's postwar program to build flood-control and irrigation projects and to extend highways and railways aimed to increase rural income and purchasing power.

The Chinese Communists, however, continued to block unification of the country. They elected their own officials, maintained their own army, and controlled border regions of north China, with Yenan as their capital. Chiang had to keep troops there to hold them within bounds. The Communists operated mines, industries, co-operative associations, and schools. They charged Chiang Kai-shek with using the war as an excuse to become dictator. Chiang offered to recognize the Communists as a legal party if they would join the National government and disband their army. The Communists refused, declaring they were combating the Japanese armies in northern China.

Postwar Problems

The collapse of Japan on Aug. 15, 1945, brought a measure of peace to strife-torn China. For the first time in eight years it was free from a foreign foe. A treaty with Russia enabled Outer Mongolia to become a nominally independent republic and restored Manchuria to Nationalist China (*see* Manchuria; Mongolia). The Chinese Communists soon seized control of Manchuria. Chiang's army then attacked.

The new civil war crippled China. Shattered transportation and appalling inflation blocked economic recovery. The drive against poverty and illiteracy virtually collapsed. In an effort to rehabilitate China, the United States sent Gen. George C. Marshall to unify Communist and Nationalist policies. Late in 1946 he admitted failure. But the Kuomintang did accept a few Liberals and wrote a new constitution for China. It became effective Dec. 25, 1947. The Communists rejected it. Chiang then declared open war on them.

In 1948 Chiang was elected president of Nationalist China; but his government was split by political rivalries, corruption, and bungling. Chiang "lost face" in some Western nations, and public opinion was

divided about whether to help him. Despite some economic aid from the United States the Nationalist forces could not halt the march of the Communists.

China Becomes a Communist Nation

In 1949 the Red armies of Gen. Mao Tse-tung, a founder of Chinese Communism, engulfed China. On September 21 Mao proclaimed the People's Republic of China. Peking (Peiping) became the capital. The republic provided not for a president but a chairman of the "Central People's Government." Mao was elected chairman. China—one fifth of the world's people—had fallen under Communism.

Chiang's Nationalist government and most of its armed forces fled to Formosa. There Chiang began to retrain his forces and put into effect a small air and naval blockade against China. Britain and a few other nations recognized Mao's regime. On Feb. 14, 1950, Mao signed a mutual defense pact with Russia. Mao declared that he would seize Formosa. After hostilities broke out in Korea June 25, 1950, the United States sent air and naval protection to Chiang on Formosa. (For Nationalist China events, *see* Chiang Kai-shek; Formosa.)

Following the Communist pattern, Mao decreed that China's lands be distributed to the peasants. By 1952 many had received a plot, but they were burdened by heavy taxes and tributes to the Communist party. Some land was taken for state farms. Mao also drove to increase industrialization. Industry made some gains, but by 1952 production lagged. Mao attributed this to "corruption" and to "deviation from Communist principles." The harsh aspects of Mao's regime met considerable resistance. This led the Communists to "try" thousands of Chinese in 1950–51 and then kill them as "counter revolutionaries."

In November 1950 Chinese "volunteer troops" suddenly entered the Korean conflict. Their "human sea" mass attacks at first routed the United Nations forces, and early in 1951 the Chinese drove back across the 38th parallel to Kaesong. Chinese casualties were huge and they agreed to a truce parley. It began July 10, 1951. Fighting, however, continued for over two years until the truce was signed on July 27, 1953 (Asiatic time). (*See also* Korea.)

Five Year Plan, Indo-China, and Plane Incident

Red China was then the strongest military power in Asia, but Mao's chief problem was to develop the nation's resources and to gain firmer control of the Chinese people. In 1952 his premier, Chou En-lai, began a vast five-year plan to develop industry and agriculture and to train Chinese technicians. Peasants paid little heed to the farm program, and industry lagged so much that Russian advisers took charge in 1953. By 1954 there was very little progress.

The truce in Korea enabled Red China to send supplies to Communist Vietminh forces fighting the French in Indo-China (*see* Indo-China). Through the Vietminh victories China was able to set terms for the cease-fire in Indo-China in 1954. This success apparently led Red China to defy the democracies. Shortly after the cease-fire Red Chinese planes shot at American planes on a rescue mission near Hainan

REFERENCE-OUTLINE FOR STUDY OF GREATER CHINA

CHINA PROPER

The Land and the People

I Location and size C-257-8, chart U 246; location in world, map W 205; in Asia, map A-406-7; political divisions, map C-260; air distances, polar projection map A-531

II Land structure C-258-9, list C-257, map C-259
- A Mountains C-258-9, list C-257, map C-259
- B Rivers A-416, C-259, list C-257, map C-259; Hwang H-454; Yangtze Y-333

III Climate C-259-60, list C-257, rainfall map A-412

IV People C-260, 262-9, pictures C-265, R-21; population C-258, A-415-16, chart U 246, density map C-262, pictograph C-261; racial origins, diagram R-22
- A Food C-260, 263, 270, pictures C-264, 267; bamboo products B-43; ginkgo G 109; sorghum S-236; trepang (sea cucumber) S-86; rice R-147
- B Clothing: children C-267-8; city C-264, 266; country C-263-4
- C Shelter C-276, 277; cities C-266; river dwellings C-264, A-416, picture C-116; villages and farms C-262-3
- D Farm life C-262-4, pictures C-263, 270, 271
- E Children C-267-9, pictures C-267, 268, 275
- F *Customs C-262-9, 274*
- G Festivals and holidays C-268-9, F-58, 59, N 194
- H Inventions: paper and printing P-66, P-414c
- I Social conditions C-274; children C-267-9; labor C-268, 272; village and farm C-262-4; World War II and aftermath C-284

V Resources and industries
- A Agriculture C-269-71, 261, 284, A-416, list C-257, maps C-262, C-493; bamboo B-42; ginkgo G-109; ginseng G 109-10; hog production H-404; millet M 255; opium O-398; peanut P 104; rice C-269-70, R-147, map C-262, pictures C-263, 270, 271; silk S-185-6; soybean S-308b; tea T 28
- B Fisheries C-264, pictures C-266
- C Minerals and mining C-272, A-416, list C-257; antimony A 265; salt S-29; tungsten T 206
- D Manufacturing C-272, S-133, H-418, H 258, H 259, S-134, F 209, N-4; rugs R-248, 250

VI Trade and transportation C-270-1, 272-3, S-134, C-116, F 209, H 258, H 259, H-418, P 111, 112, N-4, S-133, T 131. See also in Fact-Index: Trade table

VII Principal cities C-260, 261-2, list C-257; Canton C-116; Foochow F 209; Hangchow H 258; Hankow H 258; Hong Kong (British Colony) H-418; Nanking N-4; Peking (Communist capital) P 111; *Shanghai S-133; Tientsin T 131*

VIII Education and the arts
- A *Education C-274-5, E-243, F 209, N-4, P 112*, pictures E-243, C-267
- B Architecture C-276, 277, pictures C-276, 281, 282; Peking P 111, pictures P 111, 112

C. Art C-277-8: enameling E-341, picture E-342; lacquer ware L-81; metalwork M-178-9, C-277-8; painting C-277, picture P-37c; porcelain and pottery P-394, 396a, 401, color pictures P-395, 396, picture E-342; sculpture S-82, C-277; tapestries T-13, picture T-14; wallpaper W-5; wood carving W-190b
D. Literature C-275-6: Confucius C-433b, C-274, 275-6; folk tales S-409, list S-419-20
E. Music and the theater C-276: ancient puppets P-439-40; ancient shadow play, picture C-275
F. Writing C-275, 277, W-310, 310a, picture C-267

IX. Government C-278, 279, 280-83: Communism C-282-3, 285; reform movement C-280-1; republic C-281-4; constitution of 1947 C-284, Chiang Kai-shek C-228; Mao Tse-tung and the Communist People's Republic C-285

X. Religions C-274, R-101: Yang and Yin (the Chinese story of creation) C-278; Buddhism B-338-9; Confucianism C-433b; Taoism C-274; Christian missionaries C-280; New Year's Eve ceremony C-268

HISTORY

I. General C-278-85
II. Ancient civilization C-278: census C-170
III. Confucius C-433b
IV. Rise of empire—the first dynasties C-278-9
V. Early contacts with the Western World and influence on Japan C-279, J-318
VI. Mongol invasion and rule C-279, M-345: Marco Polo at the court of Kublai Khan P-364
VII. Mings overthrow Mongols C-279: new capital N-4
VIII. Manchu Dynasty (1644–1912) C-279, M-75: coming of the Europeans C-279; Christian missionaries C-280; the Opium War C-279, O-399, H-419; treaty ports and extraterritorial rights C-279-80, T-131; Taiping Rebellion C-280, G-141, H-258, N-4; war with Japan (1894–95), Korean "independence," and loss of Formosa C-280, J-320, K-65, F-242a; open-door policy C-280, M-19; Empress Tzu-hsi puts down reform movement C-280-1; Boxer Rebellion C-281, P-111, T-131; Nationalist party (Kuomintang) organized by Sun Yat-sen, revolution of 1911, China becomes a republic (1912) C-281, C-228
IX. Japan's "Twenty-one Demands" C-281, J-321
X. World War I, Versailles and Washington conferences C-281-2, W-240, H-267
XI. Internal confusion and growth of Communism C-282-3
XII. War with Japan (1937) C-283, J-321, C-229, W-252
XIII. World War II C-283-4, W-259, 268, 290
XIV. Results of the war C-284: extraterritorial rights abolished C-284; Chinese exclusion law repealed C-284, I-48; economic and social progress C-284; Formosa regained F-242a
XV. Postwar problems C-284, C-229, W-299
XVI. Communist armies engulf China—Chiang Kai-shek's government flees to Formosa C-284-5, F-242a, C-229
XVII. Mao Tse-tung proclaims Communist People's Republic of China (September 21, 1949) C-285
XVIII. Red Chinese forces enter Korean war C-285, K-66, U-242
XIX. China's five-year plan and State Planning Commission C-285

HISTORIC DIVISIONS OF GREATER CHINA OUTSIDE THE 18 PROVINCES OF CHINA PROPER

I. Formosa F-242-242a, maps W-205, A-406-7, C-259
A. Land structure and climate F-242, 242a
B. How the people live F-242a, pictures F-242
C. History F-242a: Chiang Kai-shek C-229

II. Manchuria M-71-6, maps A-406, C-259, M-72
A. Land structure and climate M-71-2
B. People M-72: farm life M-73-4, picture M-74; industrial life M-74, pictures M-73, 76; transportation M-75, pictures C-52, M-75
C. History M-75-6: Russo-Japanese War R-296, Japanese control C-283, J-321; World War II and Chinese Communist invasion M-76

III. Mongolia M-341-5, maps W-205, A-406, C-259, M-343
A. Land structure and climate M-341, maps C-259, M-343: the Gobi M-342, map A-411
B. How the people live M-342-4, pictures M-341, 342, 344: religion (Lamaism) M-344
C. History: Mongols M-345-6; modern M-344, 345
See also Mongols in Fact-Index

IV. Tibet T-127-9, maps W-205, A-406, C-259
A. Land structure and climate T-127, maps A-411, C-259: Himalayas H-355-6, map I-54 (Mount Everest E-450, pictures A-409, E-453)
B. People, religion, and government T-127, 128, pictures T-128, 129, H-356: Buddhist shrine, picture A-415; Dalai Lama, picture T-127
C. History T-129: Chinese Communist invasion T-129

V. Sinkiang (Chinese Turkestan) T-213, 214, maps W-205, A-406, C-259: people, picture A-404

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CHINCH BUG One of the most destructive pests is the chinch bug, a tiny insect about one sixth of an inch long It attacks only plants belonging to the grass family, particularly barley, wheat, rye, oats, and corn The adult bugs hibernate in the winter in grass clumps In the spring they fly into the grain fields There the female lays several hundred eggs in the ground around the plants or in leaf sheaths In one to two weeks or rarely, six tiny reddish nymphs (young bugs) hatch and feed by sucking the juices from the plants They mature in 40 or 50 days, shedding their skins five times

TWO CHINCH BUGS

Chinch bugs are both long-winged (left) and short winged (right) The short-winged bugs are unable to fly

As the small grains ripen and are cut the chinch bugs migrate to crops that are still green such as corn and sorghums Usually they crawl to the new plants but in the South, where they mature earlier they fly Following the migration a second generation is produced, and in the South a third generation

The chinch bug can be controlled most effectively by growing certain immune crops, such as legumes or resistant crops such as certain varieties of corn or sorghum Barriers of creosote or other materials placed in the migration path are effective when the bugs migrate by crawling The scientific name of the chinch bug is *Blissus leucopterus*

CHINCHILLA A rodent native to the Andes Mountains, the chinchilla furnishes one of the rarest, most expensive and most beautiful furs of commerce The little animal is 6 to 12 inches long exclusive of the long bushy tail, and weighs up to 22 ounces The thick silky fur is slate blue at the root shading to silvery gray at the tip Chinchillas live in rocky burrows at altitudes above 8 000 feet in Chile, Peru and Bolivia They are now extremely rare, and hunting or exporting them is forbidden by law They are thriving however, in fur farms of North and South America

The animals mate for life The female begins to bear young at the age of about five months She has two to four young in 111 days, and there are usually two litters a year The young are born with fur and with their eyes open In a few hours they are able to run about They may live for 15 to 20 years

Commercial breeding of chinchillas began in 1923 with 11 animals shipped to California Farms today are scattered throughout the United States The animals are being sold for breeding purposes only until their numbers are built up and there is no more danger of their becoming extinct The National Chinchilla Breeders of America sell only the skins of animals that have died a natural death There are two species *Eriomys chinchilla* and *Eriomys lanigera* The latter is the kind being raised on farms

Chinchilla cloth is a thick woolen, or wool and cotton cloth It has a long nap which has been rubbed into little tufts by special machinery

CHINQUAPIN (*ching'ka pin*) This Algonquin Indian name is given to several trees and shrubs and to their edible nuts The best-known chinquapin is a dwarf chestnut which grows in the southeastern United States Its spiny burr contains a single sweet-flavored nut A related species native to the Pacific coast is the giant or golden leaved chinquapin The chinquapin oak also called yellow, or chestnut oak and the dwarf chinquapin or shin oak, with an edible acorn grow in the Central states (*see* Oak)

The scientific name of the common chinquapin is *Castanea pumila* of the giant chinquapin, *Castanopsis chrysophylla* of the chinquapin oak *Quercus acuminata* of the dwarf chinquapin *Quercus prinoides*

CHIPMUNK The lively chattering little chipmunks are easily tamed If you offer them food and sit very still they will soon eat out of your hand Chipmunks look like their cousins the squirrels, but they are smaller and have striped backs The eastern chipmunk has three dark brown stripes and two light stripes The western chipmunk has five black and four light stripes The sides are reddish brown, the under parts white They have bushy tails about as long as their bodies The animals vary in length from 8 to 11 inches including the tail

THE EASTERN CHIPMUNK

The single white stripe on each side indicates that this is an eastern chipmunk. Its call is a cluck or rapid chuck, its alarm, a shrill whistle.

Chipmunks spend most of their lives on the ground even though they can climb trees for food Their home is a burrow under rocks or tree roots or in old logs It contains storerooms and a nest lined with leaves Here the female bears four to six young usually late in spring The young are born 31 days after mating They do not leave the nest until they are a month to six weeks old

Chipmunks eat chiefly nuts, seeds, wild fruits and berries They have inner cheek pouches which they stuff with food In the autumn they lay in supplies of nuts and seeds for the winter During the coldest months they sleep lightly in their burrows On warm days they come out to sun themselves and eat some of their stored food

Chipmunks belong to the squirrel family (*Sciuridae*) of rodents They are sometimes called ground squirrels, but the name belongs more properly to a closely related animal The eastern chipmunk (*Tamias striatus*) ranges from Canada to Georgia and west to the Great Plains Western chipmunks belong to the genus *Eutamias* Sixteen species range west of the Great Plains from the Yukon to Lower California Both genera are found in the Lake Superior region.

CHLORINE. In its pure form and in some of its compounds, chlorine is deadly to animals and human beings. In other compounds, notably sodium chloride ($NaCl$), or common salt, it is harmless and necessary to all animal life. The element presenting these contradictions is a greenish-yellow gas with an acrid, suffocating odor. It is never found free in nature, but can be obtained from salt water by *electrolysis* (running an electric current through the solution). This process yields free chlorine and sodium hydroxide (caustic soda). Chlorine gas obtained in this way is compressed to a liquid and stored in steel cylinders. In this form it is mixed in the water supply of cities to destroy disease germs; only minute quantities of chlorine are necessary. The use of chlorinated water has greatly reduced the occurrence of typhoid fever. Liquefied chlorine was the first gas used in the chemical warfare of the first World War. Commercially, large quantities of chlorine are used in making carbon tetrachloride (employed as a solvent, dry-cleaning agent, and fire-extinguisher fluid) and in the manufacture of bleaching agents.

In the bleaching process, chlorine interacts with oxygen to reduce dyes and pigments to colorless compounds. Liquefied chlorine may be used for this purpose, but chlorine compounds (which give up free chlorine in bleaching) are more commonly used. Bleaching powder, or chloride of lime, is calcium oxychloride, $CaOCl_2$. Dissolved in water, this yields calcium hypochlorite, $Ca(OCl)_2$, also used for bleaching. These and other chlorine compounds are widely used in the paper and textile industries and in the manufacture of laundry bleaches.

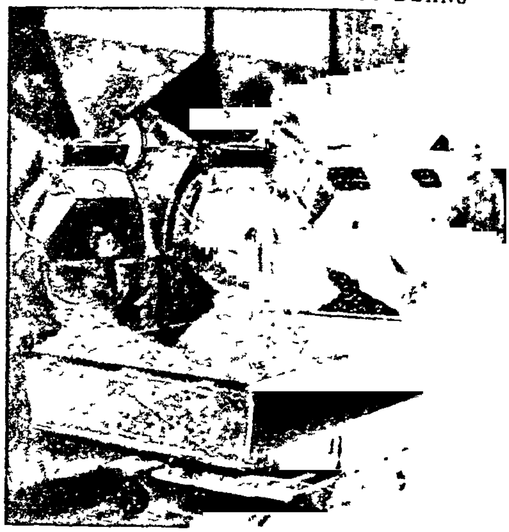
Many other compounds exist. Combined with metals, chlorine forms chlorides (such as sodium chloride), and with metal and oxygen, chlorates. These are used in such diverse industries as the manufacture of fireworks and the extraction of gold from its ores. With hydrogen, chlorine forms the useful compound hydrochloric acid (*see* Hydrochloric Acid).

Chlorine belongs to the very active group of elements called *halogens*. The name (from Greek *halos*, "salt") is given them because they combine directly with metals to form salts. The other members of the group are fluorine, bromine, iodine, and the artificial element astatine. Chlorine, at atmospheric pressure, turns to a brownish liquid when cooled to −30.3° F. (−34.6° C.). At −150.9° F. (−101.6° C.) it turns to a yellow crystalline solid.

CHOCOLATE. Of all nations of the world, the United States probably has the greatest liking for chocolate. Americans consume great quantities of chocolate in chocolate bars, chocolate-coated candies, ice cream, chocolate syrups, cakes, pies, cookies, pastries, cocoa, and dozens of other delicious products.

Chocolate is made from the seeds, or "beans," of the tropical cacao tree (*see* Cacao). The cacao bean fresh from the pod has a very strong bitter taste, and the process of making the product appetizing begins in the tropics. The workers clip the pods from the trees with a curved knife at the end of a long pole, and leave the pods on the ground to dry. The almond-shaped beans are then shelled out and heaped into piles to be *sweated* for several days. The sweating, or fermenting, removes the pulp from the outside of the beans and brings about chemical changes within the beans. After drying, which gives the beans their rich brown color, they are bagged for shipment.

ROASTING THE CACAO BEANS



Roasting the chocolate beans as they come from the tropics is a delicate process. Too little heat would fail to bring out the rich flavor of the chocolate and too much would spoil it.

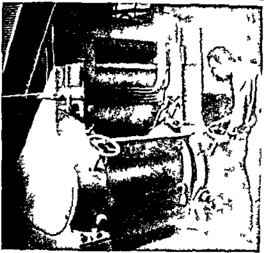
When they arrive at the factory they are put in large roasting machines. Roasting improves flavor and also dries the thin husks so that when the beans are crushed between rollers the husks come off easily. Fanning and sifting separate the husks, the germ of the seed, and the cocoa *nibs*, as the main part of the bean is called. The husks are sometimes used as fertilizer, as food for cattle, or as a substitute for coffee. The nibs are the part used for chocolate products.

The nibs are now ground between successive sets of granite stones or steel rollers. The friction melts the fat in the beans and reduces the solid part to powder. The result is a smooth, dark-brown liquid. From this point onward, further processes differ according to whether the final product is to be cocoa, baking chocolate (sweet or bitter), or milk chocolate.

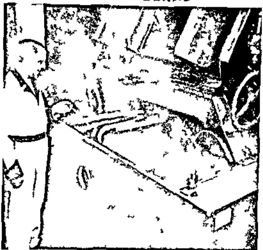
For cocoa, the liquid chocolate is compressed in hydraulic presses that squeeze out about half the *cocoa butter*, as the fat is called. The resulting cakes, light brown in color, are then ground, sifted, and packaged as breakfast cocoa. The yellowish cocoa butter is cooled in bars and used in making soap and pomades. Some is set aside for use in milk chocolate. Cocoa butter has a pleasant chocolate taste and odor and does not easily become rancid.

In making dark baking chocolate, the liquid chocolate is further refined in grinding machines called

GRINDING AND REFINING THE NIBS OF THE BEANS



After roasting the husks and seed germs are removed from the beans leaving the nibs of pure chocolate These are ground between stones or as shown at the left between steel rollers



The thick brown liquid resulting from grinding may go next to a machine called a longitudinal (right) *Here for 96 to 120* hours the liquid chocolate is refined by a heavy granite roller

conches or *longitudinals* In these a granite roller passes back and forth over a flat granite stone Grinding in the longitudinals goes on continuously for four days and nights Finally the refined chocolate is poured out in molds as dark bitter chocolate for baking and candymaking For sweet dark chocolate sugar and starch are added before molding

Milk chocolate requires other ingredients A solution of milk and sugar is boiled down almost to a paste and the liquid chocolate is poured into this After some drying by evaporation cocoa butter is added and the mixture is ground for five days and nights in longitudinals It is then molded either by hand or by automatic machinery and the bars are wrapped in foil or glazed paper

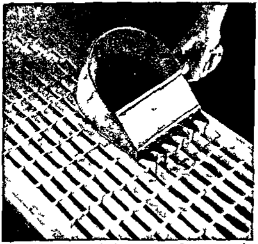
History of Chocolate

Chocolate was first enjoyed in America for the cacao tree was a native of the New World Our word chocolate in fact comes from the Aztec word *chocolatl* Europeans became acquainted with it in Mexico where it was a favorite beverage and Hernando Cortez demanded 300 loads of chocolate from Montezuma emperor of the Aztecs as part of the tribute to be paid Chocolate was introduced into England in the reign of Charles II about the same time as tea and coffee and had become a popular beverage throughout Europe by the early part of the 18th century It was so highly esteemed that the great botanist Linnaeus gave the cacao tree the botanical name *Theobroma* meaning food of the gods

The chocolate industry grew as better refining methods were developed and as cacao plantations were established in many tropical lands The process of making milk chocolate developed in Switzerland about 1876 increased the popularity of chocolate products Today the industry is a big one in the United States which absorbs nearly half the world production of cacao beans Other important manufacturing countries are the United Kingdom the Netherlands France and Germany

Chocolate is a highly concentrated food One pound of sweet milk chocolate contains nearly 2 500 calories nearly twice as many as a pound of beef or a dozen eggs About half the composition of milk chocolate is carbohydrate and about one third is fat. There is a small amount of *theobromine* a stimulating alkaloid similar to the caffeine found in tea and coffee Chocolate is an excellent emergency ration for soldiers and explorers because of its small bulk in proportion to the nourishment it contains

MOLDING BARS OF CHOCOLATE



The refined chocolate mixed with sugar is finally ready to be poured out into molds This may be done by hand as here in large factories it is often done by automatic machinery

CHOPIN (*shō'păn*), **FRÉDÉRIC FRANÇOIS** (1810–1849). Many believe that Chopin was the greatest of all composers for the piano. For a hundred years people have loved his romantic nocturnes and mazurkas, his warlike polonaises, and his graceful waltzes.

Chopin was born at Zelazowa Wola, a village near Warsaw, Poland. His father, Nicholas, was French but he had lived in Poland for many years. His mother was Polish and of noble birth. When Frédéric was born, Nicholas was tutor to the son of a Polish count and the Chopins lived in a tiny house on the count's country estate. They moved to Warsaw several months later. Here Nicholas became professor of French at the Lyceum, or high school.

FRÉDÉRIC FRANÇOIS CHOPIN

This is the only photograph ever taken of the great Polish composer.

The Chopin home in Warsaw usually overflowed with children. Frédéric had three sisters, and Nicholas Chopin kept a small boarding school for boys. The house was cheerful and often noisy, but the home life was cultured. The Chopins' friends were among the intellectuals and aristocrats of Warsaw.

Even as a small child, Chopin loved piano music. He began to take piano lessons when he was six. He started to compose before he knew how to write down his ideas. At eight he played in a public charity concert. His first published work, a rondo, appeared when he was 15. When he graduated from the Lyceum, at 17, he was recognized as the leading pianist of Warsaw and a talented composer.

Chopin gave two concerts in Vienna when he was 19. These received great praise. He returned to Vienna the next year, and while he was there Poland revolted against its Russian rulers. The uprising failed, and the Czar put Warsaw under harsh military rule. Chopin therefore decided to go to Paris.

Except for occasional trips, Chopin spent the rest of his life in Paris. He gave lessons and concerts, and publishers paid well for his compositions. The French loved him for his genius and his charm. Poets, musicians, wealthy Parisians, and Polish exiles were his friends. An important influence was a romantic friendship with Baroness Dudevant, better known as the novelist George Sand.

Chopin was not able to enjoy his success fully. At the age of 28 he developed tuberculosis; and his last years were spent in weakness and suffering.

Among Chopin's works are 49 mazurkas, 25 preludes, 24 études, 19 nocturnes, 13 waltzes, 11 polonaises, 4 scherzos, 4 rondos, 3 sonatas, and 2 concertos.

CHOSEN (*chō'sĕn'*). In ancient times the Korean peninsula was called Chosen; later it became Korea. When the Japanese annexed it in 1910 they restored the name of Chosen. After the peninsula was freed in 1945, the name Korea was restored (*see* Korea).

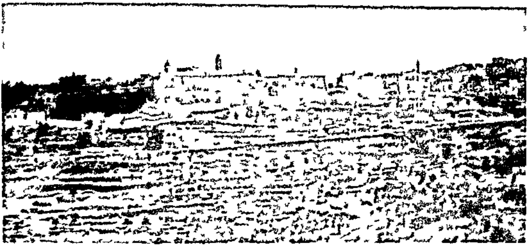
CHRISTIAN, KINGS OF DENMARK. Ten kings of Denmark have borne the name Christian. The ninth ruler (from 1863 to 1906), is the most interesting. In 1864 he lost the duchies of Schleswig and Holstein to Prussia and Austria as a result of the "blood and iron" policy of Bismarck. But though Christian IX's kingdom was small and unimportant, members of his family occupied exalted positions. His eldest son Frederick VIII succeeded him as king of Denmark. Another son was chosen king of Greece (George I) in 1863. One daughter, Dagmar (Marie Feodorovna), became empress of Russia through marriage to the czar Alexander III. Another, Alexandra, was queen of England as the wife of Edward VII. A grandson became king of Norway in 1905 as Haakon VII. Thus many of the sovereigns of Europe before the first World War were related to the reigning house of Denmark. Because of this, Christian IX has been called the "grandfather of Europe."

Another of this name, Christian IV (ruler 1588 to 1648), briefly championed the German Protestants in the Thirty Years' War. Christian X, who succeeded his father, Frederick VIII, in 1912, was called the "tallest monarch in Europe" (6 feet, 7 inches). His democratic rule won such prestige that the German invaders let him keep his throne in the second World War despite his refusal to collaborate. On his death in 1947, he was succeeded by his son, Frederick IX.

CHRISTIAN ENDEAVOR, YOUNG PEOPLE'S SOCIETY OF. On Feb. 2, 1881, the Rev. Francis E. Clark, a Congregational pastor in Portland, Me., gathered about 50 young people in his parlor and organized the first society of Christian Endeavor. From this small beginning the movement has spread until it includes more than 80,000 societies in all parts of the world, with an aggregate membership of about 4,000,000.

The International Society of Christian Endeavor comprises the various societies of North America, which are also organized into city, county, and district unions. The World's Christian Endeavor Union, including societies of all countries, holds a world convention every four years.

Most of the societies have a constitution that declares the purpose to be "to promote an earnest Christian life among its members, to promote their mutual acquaintance, and to make them more useful servants of God." The members bind themselves to attend every meeting of the society to which they belong, unless prevented by absolute necessity, and to take some part, however slight, in every meeting. They are to read the Bible daily and to assist the pastor in the work of the church as he shall direct. The society is interdenominational.



In this little town of Bethlehem in the hills of Palestine the Christ Child was born The two towers of the Church of the Nativity rise at the left The church stands on the site of the stable in the cave which was the Child's birthplace

CHRISTMAS CUSTOMS *in the* NEW WORLD *and in the* OLD

CHRISTMAS The most joyous and blessed day of the year is Christmas December 25 when Christians all over the world celebrate the birthday of Jesus Christ Their thoughts go back to that first Christmas morning nearly 2 000 years ago when the newborn Christ Child lay in a manger in the Holy Land From that humble birthplace the Child brought new faith and new hope to the world Simple shepherds and Wise Men alike knelt before the Holy Child in devoted thanks for His birth (For the story of the birth of Christ *see* the article Jesus Christ)

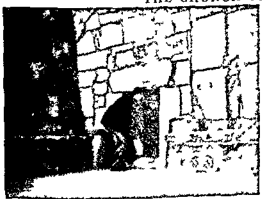
Today men women and children in every Christian land crowd into churches to give their thanks Many attend midnight services on Christmas Eve Beautiful decorations adorn the churches and rich music swells from organ and choir The splendor and beauty is very different from the humble stable in Bethlehem where Christ was born but the message He brought to the world is the same— Glory be to God in the highest and on earth peace good will toward men

Christmas in the Holy Land

On Christmas Eve in Bethlehem a long procession winds through the narrow streets At its head march the church dignitaries priests and acolytes Their magnificent robes gleam in the light of their candles They carry a tiny gilded wicker cradle in it lies a beautiful wax image of the Infant Jesus

At the old fortresslike Church of the Nativity they pause as each worshiper stoops to enter the low door They gather in the Roman Catholic Chapel of St Catherine the Latin wing of the Church of the Nativity for the celebration of midnight Mass Pilgrims from all the world worship during the reverent yet joyous singing The ceremony ends when the

THE CHURCH OF THE NATIVITY

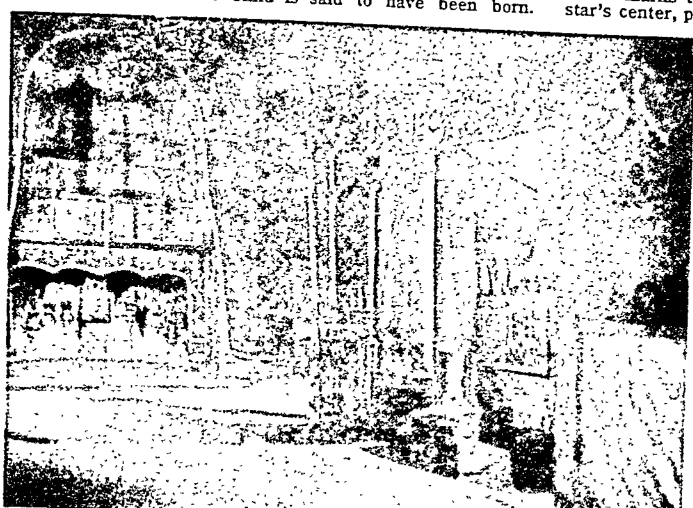


This tiny entry is all that is left of the original door which was sealed during the Crusades to bar mounted Saracen warriors

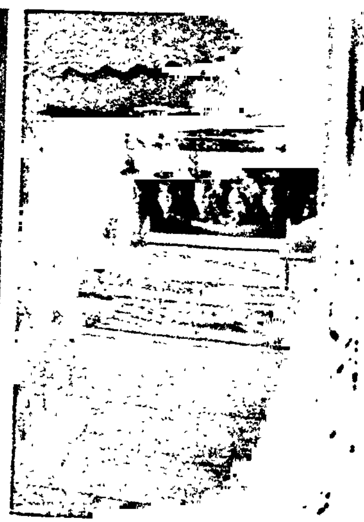
Ornate lamps filled with pure olive oil light the vaulted interior of the Church of the Nativity built by Constantine in 327

GROTTO OF THE NATIVITY—THE BIRTHPLACE OF CHRIST

Under the Church of the Nativity is a grotto, once the cave-stable where the Christ Child is said to have been born. A star marks the supposedly exact spot. Through a hole in the star's center, pilgrims put their hands down to the holy place.



This is the Grotto of the Nativity. The church belongs to the Orthodox Eastern faith but contains a Roman Catholic altar.



Here is the canopied Manger, raised on marble and lit by lamps on gold chains. Inside is a wax image of the Infant Jesus.

Patriarch of Jerusalem carries the image of the Christ Child to the ornate glass and marble manger in the Grotto of the Nativity under the church.

On the day before Christmas, there are all-denominational services in the nearby Field of the Shepherds and in the courtyard of the Church of the Nativity.

A Gala Day for American Children

Christmas is a *joyous* religious feast, and Americans have extended the glad spirit of the day to bring extra happiness to children. For fortunate American youngsters it is an exciting day of gifts, sparkling Christmas trees, red and white candy canes, turkey, cookies, and ice cream.

In the North people hope for a "white Christmas," when colored lights in the homes, store windows, and even the streets will glisten against fresh snow. Two loved Christmas songs herald the gay beauty of a snowy yule—'Jingle Bells' and 'I'm Dreaming of a White

Christmas' The season has become increasingly commercialized by stores and other businesses, but to children there is still only the glad, friendly spirit of 'Merry Christmas to all!'

All Help to Make Christmas Festive

Preparations to make the yule season the cheeriest of the year begin long before Christmas Day Right after Thanksgiving the stores begin to put on their *Christmas dress of gleaming decorations* Parades with beautiful floats thread the main streets of large cities Small towns as well as great cities line their business streets with red green and other colored lights, giant wreaths of holly or evergreens, bells and colorful storybook figures

Loud-speakers spread the festive music of chime and carols On corners and in stores stand the jolly red-suited 'helpers of Santa Claus' (*see* Santa Claus) In residential sections the tangy freshness of fir and pine drifts from Christmas trees Wreaths green scarlet ribbons, and candles decorate homes Colored lights sparkle like stars in trees on the lawns or on the outlines of the houses The very air seems to tingle with eagerness and good cheer

Schools and other groups rehearse pageants and plays to be given just before the holidays In many schools boys and girls clean and mend their old toys for less fortunate children Classes send letters to students in other communities or in foreign lands

Charity and Good Will to the Needy

The American Christmas especially remembers the needy Every community sees that some joy comes to its less fortunate members Schools, churches and charitable civic groups collect food and clothing to be given to the poor Many groups give entertainment and presents to children whose parents cannot

In many places Christmas Eve is an outdoor community festival—a custom that may have come from the outdoor fetes of Spain and Italy Young and old gather around a huge Christmas tree for carols In Altadena Calif, is another type of community fete Hundreds of giant evergreen trees planted along both sides of a road, are hung with colored lights to form a "mile of Christmas trees" In the South fireworks flare on Christmas Eve and boom on Christmas Day

Christmas Helps World Business

The Christmas celebration helps thousands of persons to make a living They range from American manufacturers and farmers to glass blowers in Germany and Japan, who make ornaments for Christmas trees Decorations colored papers for wrapping gifts ribbons seals and greeting cards all represent large businesses Christmas food is a major item in trade

Christmas trees also provide considerable business Once trees were cut wastefully, now the increasing practice is to cut only where crowded young evergreens need to be thinned out

The Manger Scene

Most American Christmas customs were brought here by the colonists from their various homelands An especially beautiful custom from Latin lands in the religious spirit of Christmas is the manger scene

THE NATIVITY SCENE

In this manger scene Giotto shows the 'Adoration of the Kings' The fresco is in the Capella Scrovegni in Padua Italy

Today in the United States, as in Europe through the centuries the manger scene—or creche—holds reverent interest

This is a small model of the cave-stable where the Christ Child was born, with figures of people and animals Italians call it the *presepio* In Spain it is the *nacimiento*, in France the *creche*

Nearly every Catholic church in the world also has its manger *scene, or crib* St Francis *is said* to have started the custom On Christmas Eve in 1224 he is supposed to have set up a stable in a corner of a village church near Assisi, with real persons and an-

imals to represent those of the first Christmas. Today the usual manger scene is a hill built of stones, covered with moss or greens. The figures of Mary and Joseph are near the cradle. In the background are the animals, shepherds, and the Wise Men. Above the hill are suspended angels, or a star, or dove.

In Catholic lands the whole family helps to build the scene, usually on a table in a corner of the living room. At twilight on Christmas Eve the children light the manger scene with candles. They relight them every night until Epiphany, or Twelfth-night, which is the twelfth day after Christmas. The scene is then put away for the next Christmas season. Many American homes follow this lovely custom.

CAROLING THE TIDINGS OF CHRISTMAS

Members of the Madison Square Boys' Club of New York City carry on English tradition as they carol for neighbors and shut-ins. Their costumes are of the days of 'A Christmas Carol'.

Carols Herald Approach of Christmas

Traditional songs, called carols, add to the beauty and fellowship of the Christmas season. Their name in France is *noëls;* in Italy, *le pastorali;* in Germany, *Weihnachtslieder*. They probably began in the early church when, accompanied by songs of joy, Nativity plays told the story of Christ's birth.

Outdoor carol singing seems to have started in the Middle Ages when groups of people went from house to house to sing by torchlight. Through the centuries musicians wrote new carols, some sacred and others to celebrate feasting and drinking. Some of the best-loved carols are 'Silent Night, Holy Night', 'The First Nowell', 'God Rest Ye Merry, Gentlemen', and 'We Three Kings of Orient Are'.

Christmas Gifts Are an Ancient Custom

Giving presents is part of Christmas. The custom seems to go back to the ancient Romans, who distributed gifts during their midwinter festival. In the Bible story, the Wise Men, or Magi, brought gifts to the Christ Child the twelfth day after His birth.

In some countries, such as Italy and Spain, children do not get their presents on Christmas—they receive them on January 5, the eve of Epiphany. In several northern European countries they get them December 6, which is the feast of St. Nicholas, patron of children (*see* Santa Claus).

The Christmas Tree and Evergreens

The Christmas tree came into general use in comparatively recent times. The custom began in Germany and was first mentioned in an anonymous chronicle in 1605. There is a story, however, that Luther started the custom much earlier, putting candles on an evergreen to represent the stars on Christmas Eve.

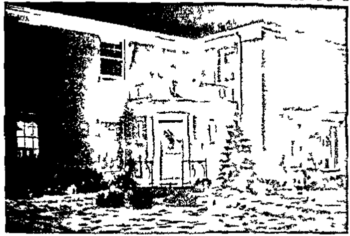
Another story tells of St. Boniface when he was a missionary in Germany in the 8th century (*see* Boniface, St.). He was trying to stamp out the pagan rite of sacrificing people to the oak tree. He led his followers into a forest at yule time. Showing them a fir tree, he said it pointed straight upward to the Christ Child. "Take this tree into your homes," he said, "as a sign of your new worship [Christianity]. It [the fir] lives when earth is darkest and has no stain of blood. Celebrate God's power no more in the forest with shameful rites, but in the sanctity of your homes with laughter and love."

By the beginning of the 19th century nearly all Germany had adopted the Christmas tree. The custom

GOOD ST. NICHOLAS

In French and Dutch legends, St. Nicholas, bishop of Myra, distributes gifts. He is the forerunner of Santa Claus.

OUTDOOR DECORATIONS LEAD TO CHEER WITHIN



Outdoor decoration of homes (left) has become quite elaborate in many places. The scenes make a neighborly Merry Christmas

Trimming the family tree (right) is happy work. On Christmas Day it glistens with 'snow,' tinsel, lights and little gifts

soon spread to most countries of northern Europe but is still unusual in Italy, Spain and Latin America. The date of the first Christmas tree in the United States has been given as 1804 at Fort Dearborn in Illinois, but research has failed to substantiate it; the date now accepted is 1832 in Cambridge, Mass.

The use of evergreens for yule decorations began in northern Europe. Sweden, however, uses flowers because evergreens there symbolize death and grief. Italy, Spain and some other nations also use flowers. Mistletoe too is a custom from northern Europe, where people once placed it over doorways as charms (*see* Mistletoe). The use of holly arose because its prickly leaves resembled Christ's crown of thorns and its scarlet berries suggested blood droplets.

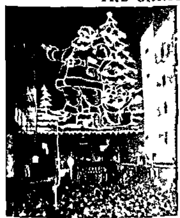
Christmas Today in Northern Lands

In Scandinavian countries the yule celebration begins on Christmas Eve and ends in a Twelfth-night party. Cakes or bread loaves baked in the shape of a boar recall ancient feasts of real boar meat. Little straw goats symbolize the old custom of saving the last sheaf of the harvest for its magic. In many places the stock get special feed, and birds find sheaves of unthreshed grain put out for them.

On Christmas Eve the family gathers round its lighted Christmas tree. There may be a visit from the *Tomte* (also called *Tomtar*), who are kindly gnomes like brownies. One, as an old man, has a long white beard, wears a red cowl and rings a bell; the other, as an old woman, carries a basket of gifts.

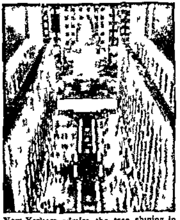
After games or songs comes a grand supper at 9 or 10 o'clock. The chief dish is *lutfisk*, dried fish that has been buried in ashes or soaked in lye water for days. Dessert is a rice porridge holding an almond or plum, and the one who gets it will be lucky for the next year. On Christmas Day country people go to

THE CHRISTMAS SPIRIT IN PUBLIC PLACES



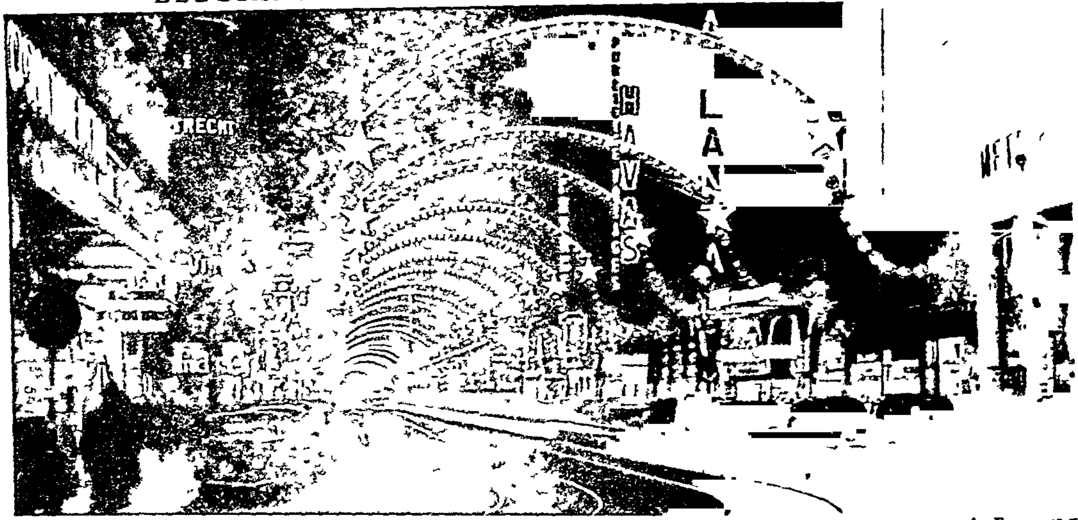
In snowless Miami, Fla., a neon Santa and Christmas tree delight downtown throngs

A giant tree in a huge railroad station is a friendly sight to travelers



New Yorkers admire the tree shining in Rockefeller Plaza among the skyscrapers.

BELGIANS WELCOME THE COMING OF CHRISTMAS



Great arches of colored lights and stars help bring yuletide gaiety and good will to the main streets of Brussels, Belgium. Such extensive decoration is not as common in Europe as in the United States, where even small towns "dress up"

church while it is still dark. They rush home, for the first to arrive is said to be sure to reap his grain first in the next summer's harvest

Christmas in Western Europe

Where old customs still exist, a man dressed as St. Nicholas visits German homes on December 5 and asks the children how they behaved during the year. On the feast of St. Nicholas, December 6, good children get gifts; the bad, switches The happiest time for most German children is Christmas Eve when the whole family gathers about the tree to sing carols.

In Bavaria people representing the Holy Family give pageants on the roads; and tiny lighted trees are set over children's graves on Christmas Eve. In some places boys dressed as the Wise Men tell the Christmas story from house to house.

In Belgium and the Netherlands Christmas is almost entirely a day of church services and quiet family gatherings. In some Dutch villages the young men meet before dawn in the market place to carol. The leader holds aloft a pole with a lighted star to represent the bright star that guided the Wise Men.

The children's special day is the feast of St. Nicholas, December 6. The evening before, the kind saint calls at homes to ask about the children's behavior. The family has spread a white sheet on the floor, and his arrival is announced by a shower of sweets on it. As the children scramble for them, St. Nicholas enters, accompanied by his servant, who holds a rod in one hand for naughty children. After briefly warning or praising the children, and perhaps hearing them recite a verse, St. Nicholas promises to return.

The children then set their wooden shoes in the window or fireplace, or hang stockings, or set out baskets to receive St. Nicholas' gifts. They do not forget, however, to leave food in them for his white horse. While the children sleep, St. Nicholas comes back to cram the shoes or stockings with gifts.

France makes a great fete of yuletide. Street booths show gifts weeks before Christmas, but Christmas trees are rare. On Christmas Eve children expect either the Christ Child (*Petit Noël*) or Father Christmas (*Bonhomme Noël*) to fill their shoes with candy and toys. Grownups exchange gifts on New Year's Day. Almost every French family has a crèche.

Some village children carry a little candlelighted crèche through the streets while they carol for pennies. Many districts give Nativity plays, little changed from medieval days. People attend midnight Mass on Christmas Eve, then many make merry all night at family gatherings called *réveillons*.

Yuletide in Eastern Europe

In the Balkans and in other lands where the Orthodox Eastern faith prevails, Christmas is not merely the festival of Christ's birthday. The people feel that the Christ Child is actually reborn each Christmas and they leave an empty chair for Him at the table and by the fire. Many people strew the floor with hay or straw to symbolize the Bethlehem manger. Ceremonies differ regionally, but everywhere the moment comes when someone says or chants, "Christ is born!" The others answer joyfully, "He is born indeed!"

The yule log is the center of festivities in the Balkans. The Serbs of Yugoslavia bring it in at sunset and burn it all night. On Christmas morning a neighbor enters the house. He throws a gloveful of wheat over the family and strikes the log with a shovel. As the sparks fly, he says: "May you have this year so many oxen, so many horses, so many pigs, so many beehives full of honey, so much happiness."

In Rumania families bake a special cake to represent the swaddling clothes of the Infant Christ In the daytime from December 24 to 31, children hold processions. They carry a *steaua*, a six-pointed

wooden star high on a pole A candle gleams through the star s covering of colored paper and little bells tinkle around it At night children go from house to house singing greetings (*colinde*) carrying long bags to receive gifts

Christmas in Italy and Spain

In Italy and Spain devout Catholics observe a one-day fast which starts at sunset on December 23 The holy season lasts until Epiphany Nearly every home has its reproduction of the Nativity scene In southern Italy children go about reciting Christmas pieces the week before Christmas Singers and bagpipers dressed as shepherds go from house to house asking permission to chant carols before the *presepio* on Christmas Day

Italians and Spaniards decorate with flowers instead of evergreens and some trim olive trees with oranges for Christmas trees In the colder parts of Italy people light a yule log (*ceppo*) on Christmas Eve In both Spain and Italy fireworks crackle on Christmas Eve

In Italy on Christmas Eve the children recite poems or little speeches before the *presepio* At sunset cannon boom to signal the start of the holy festival After prayers families break their fast with feasts of macaroni eels sweetmeats and usually a capon stuffed with chestnuts They then draw presents from an Urn of Fate Later many join processions carrying a wax image of the Holy Babe to church for midnight Mass

The Spanish Christmas Eve *Noche Buena* (Holy Night) is more of a carnival At night every home lights little oil lamps and illuminates the image of the Virgin with tapers Children dance around the *nacimiento* (Nativity scene) to the music of tambourines and sing traditional joyous Nativity songs

Young men and women dressed in their finest push through merry crowds in the streets to see the brilliantly lighted shops At midnight bells call everyone to Mass Afterward merry crowds fill the streets watching groups dance the lively *Jota* the favorite Christmas dance They stay far into Christmas morn

Spanish children receive small gifts at the street festivals but in Italy wherever there is a yule log presents are usually given when the log is put on the fire On Christmas Day children may get small gifts and candy, on New Year s Day relatives give them money In Italy and Spain however the evening of January 5 is when children put out their shoes in hope of gifts In Italy an old woman *La Befana* (the goblin) dressed in rags rides a broom stick She is supposed to leave ashes in the shoes of bad children and gifts for the good In Spain it is the Three Kings or Wise Men who fill the children s shoes with gifts

Christmas in Mexico

Mexicans observe Christmas chiefly as a religious feast The celebration begins December 16 and ends on Christmas Eve People everywhere hold *posadas* or pilgrimages to recall the experience of Mary and Joseph going from house to house in search of shelter Each community chooses nine families one of them makes a posada each night Carrying images of Mary and Joseph the family goes from house to house singing at the door and asking permission to enter

Meanwhile people are holding a festival in each house The pilgrims are refused admittance until they reach the house which contains a special altar—a different house each night They enter that house and a mass is said The mother of the family making the posada on the last night becomes the godmother and lays the image of the Christ Child on the altar

STORE DISPLAYS ENCHANT YOUNG AND OLD

Store windows filled with decorations and gifts are like fairyland at Christmas time These youngsters press cold noses to the window for a close look

Large department stores spend months preparing spectacular aisle displays with a new theme yearly This is in Marshall Field and Company Chicago.

between Mary and Joseph. All then attend midnight Mass and afterward go to the godmother's house for supper and a dance. People in many villages also give old plays called *pastorelas*, or pastorals.

Mexican children receive their gifts on January 6. A large, rough earthenware jar, called a *piñata*, filled with gifts, sweets, and nuts, is hung from the ceiling or from a tree in the patio. The young people, blindfolded, try to break the jar with a stick. When a lucky blow shatters it, they all snatch off their blindfolds and rush for the gifts.

South of the Equator

South of the equator, in Brazil, Argentina, and Peru, Christmas is the midsummer holiday. There is no snow. In Lima and elsewhere in Peru, people hold carnivals in the streets, and the air is gay with the strumming of guitars and the click of castanets. In Buenos Aires a great Christmas fair centers on a giant, electrically lighted tree in the plaza.

The Great Yuletides in "Olde England"

In no land and in no age has the celebration of Christmas been more elaborate and festive than in the England of the 16th and 17th centuries. The celebration began on Christmas Eve, or sometimes as early as December 16, and lasted until Twelfth-day. Pomp and revelry filled the royal palace, the great castles, and the manor houses. Every peasant hung mistletoe over his door and flung a yule log on his fire. Everyone kept holiday, except the bustling cooks and kitchen servants who prepared the feasts.

At the start of the Christmas season, or often as early as Halloween, a Lord of Misrule was appointed—a "grand captaine of mischief" he was called by a Puritan in the days of Queen Elizabeth I. He appointed guards, and all decked themselves with ribbons and put bells on their legs. This "master of disports" managed the games and entertainments.

Mummers, Wassail, and Waits

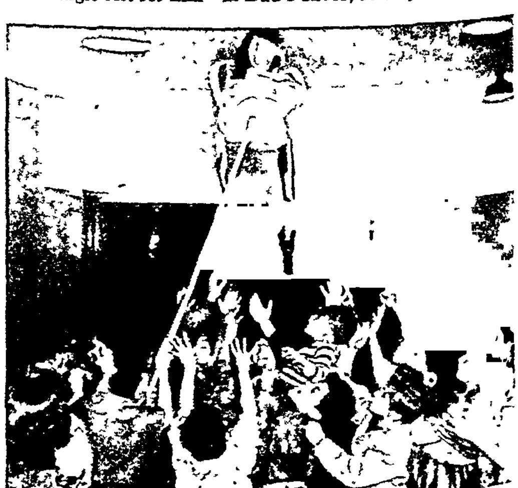
Mummers, or masqueraders, roamed in gay groups, singing and dancing, or giving rude burlesque plays. Girls usually dressed as boys, and men as women. Favorite figures for masquerade were St. George, the dragon, Hector, and Alexander the Great.

Every home, rich and poor, had its wassail bowl of hot, spiced ale or cider. In some places young farm

OLD CUSTOMS ARE EVER NEW

Little Hans, in West Germany, gleefully grins at what Kriss Kringle left for him—in Dad's shoes, as they are bigger.

In keeping with a hospitable custom of Poland, this happy Chicago family is leaving a chair empty for an unexpected guest.



Eager Mexican children at a Chicago Catholic youth center hope the girl with the pole will break the *piñata*, holding their g

YULETIDE IN MANOR HOUSE AND CASTLE

At left four beruffed boys of Elizabethan England drag in the yule log A young mother holds her son on it In cap and bells is the Lord of Misrule At right a medieval seneschal leads a boar s head parade from the kitchen into the castle

men or girls went from house to house carrying a wassail bowl decorated in ribbons and garlands and inviting all to drink wassail (good health)

People sang carols all the season—religious carols morning and evening and gayer carols at merrymaking Musical groups called *waits* paraded the streets at night or sang and played *in manor halls for gifts*

Christmas Eve in an Elizabethan Manor Hall

The pillars of the great hall its tapestried walls and all the windows gleamed with holly bay laurel and rosemary From the ceiling and over doorways hung clumps of mistletoe heavy with berries for one was plucked for every girl kissed beneath them Servants piled the massive oak tables with sirloyns of beef capons geese little roast pigs and meat pies There were great dishes of plumb porridge the forerunner of plum pudding symbolizing the richness of the Wise Men s gifts platters of brawn the pressed and pickled meat of the boar and fancy little currant cakes called yule babies

As the smiling lord and his lady and their neighbors and tenants watched boys dragged in the yule log A Christmas candle of *monstrous size was* lighted and placed on the high table to burn through all the 12 nights

At the first flicker of the candle the feasting and merrymaking began with carols and wassailing One of the favorite games was snapdragon in which the players tried to snatch a raisin from a bowl of blazing spirits with their fingers

Here he comes with flaming bowl
Don t he mean to take his toll
Snip Snap! Dragon
Take care you don t take too much
Be not greedy in your clutch
Snip Snap! Dragon!
With his blue and lapping tongue
Many of you will be stung
Snip Snap Dragon

As midnight neared the chimes rang out and waits sang the joyous tidings of the Christ Child s coming Then all the merrymakers trooped to a midnight *church service The woodsy fragrance of evergreens* filled the church On early Christmas morning every one attended another church service This was followed by breakfast in the manor hall

The Great Christmas Feast

By 11 o clock all were ready for the ceremonious Christmas dinner Heralded by trumpets and minstrel music the Lord of Misrule entered the hall Behind him marched the head servingman or *sewer* holding high a silver platter It held the most important dish of the feast a boar s head garlanded with rosemary and bay with an apple or lemon in its mouth Torchbearers accompanied the sewer fol

CHRISTMAS IN OLD NORWAY

Peasants tied bundles of oats to sticks lifting them over the houses They believed that the oats helped to ward off evil.

lowed by a stately procession of nobles, knights, and ladies. Moving toward the great table, they chanted:

The boar's head, I understand,
Is the chief service in this land;
Look wherever it is to be found
Servito cum cantico.

Amid the singing, the sewer set the platter before his lord. The fairest lady of the company then carried high another platter bearing a peacock. The proud bird had been skinned, stuffed with spices and sweet herbs, roasted, and then sewed into its own skin, with all the brilliant plumage still on. The fair lady had the honor of serving it.

After these ceremonies, servants brought the wassail bowl to fill the mugs. Following the many toasts, the long feast began, lasting into the night.

Boxing Day and Twelfth-day

In the church calendar the day after Christmas is St. Stephen's Day. It is commonly known in England, however, as Boxing Day, due to the custom of giving Christmas boxes of money to servants, tradesmen, and others who serve the public. The custom originated with the ancient Romans.

In the old English Christmas season, Epiphany, or Twelfth-day, was also a day for presents. In memory of the Magi the English ruler presented gold, frankincense, and myrrh at the altar; and the people exchanged gifts. A feature of Twelfth-day was a huge cake containing a bean. Whoever got the piece with the bean was king for the day, with the envied title of "King of the Bean."

Yuletide celebrations reached their height about the time of Shakespeare. Under the Puritan regime they were banned. When Charles II came to the throne many of the old customs were revived and still exist, but the celebration of a 12-day-long festival has passed. Only Boxing Day and Christmas Day are observed. On Christmas Eve the children expect a visit from Father Christmas.

Christmas in the American Colonies

Colonial New England did not celebrate Christmas. The stern Puritan colonists believed that such festivities were wholly pagan and forbade them by law. A Massachusetts law enacted in 1659 read: "Whoever shall be found observing any such day as Christmas or the like, either by forebearing of labor, feasting, or in any other way . . . shall be subject to a fine of five shillings." The Puritan influence was so strong that not until the middle of the 19th century did Christmas generally become a day of festivity and gift-giving in the United States.

The fun-loving Dutch colonists of New Amsterdam, however, celebrated Christmas as their chief holiday. They brought the old customs from their homeland, especially the Christmas stocking and observance of the feast day of St. Nicholas.

In the Southern colonies the planters celebrated the yuletide with feasting, singing, and dancing. On many plantations slaves were given a holiday as long as the great yule log burned.

The Origin of December 25 as Christmas

The exact date of Christ's birth is not known. For the first two centuries, while Christians were being persecuted for their new faith, the Christian church did not celebrate Christmas. Soon after A.D. 200, however, Christmas was being observed, but on various dates—especially January 6, March 25, and December 25. By the middle of the 4th century the church in the West (the Roman Catholic church) was celebrating Christmas on December 25. Later various branches of the Orthodox Eastern church also accepted December 25 for observing Christ's birthday.

In England the festival came to be called *Christes Masse* (Christ's Mass) because a special Mass was

AMERICAN YOUNGSTERS PRESENT OLD ENGLISH MUMMERS' PLAY

Here at the Pine Mountain Settlement School in Kentucky, "St. George," right, holding high a wooden sword, has "slain" the dragon. It lies on the floor. Everyone seems to have enjoyed the battle. The boys helped make their own costumes

id that day The French name *Noel* the Spanish *Navidad* and the Italian *Natale* mean birthday Germans call the season *Weihnachten* holy nights

Many Customs Even Older Than Christianity

Many of the customs now associated with Christmas go back thousands of years when the people of Europe worshiped pagan gods They celebrated the winter solstice December 21 or 22 as the birthday of the sun—heralding the beginning of longer days The early Christian church took the ancient festival time and gave new meaning to it—the religious meaning of Christianity—and made it a holy season Many of the customs can be traced back to the pagan midwinter festival of the Teutonic people of northern Europe It was their gayest time of the year They called the month Yule or *Jol* from which comes the word 'jolly Closed in by winters of bitter cold and long nights they rejoiced when the year's shortest day passed for they knew the sun would then grow stronger and the days longer

The Yule Log and Boar s Head

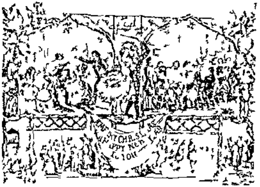
Two of their great festival customs were bringing in the yule log and the procession of the boar s head The great yule log was brought in on Christmas Eve and was lighted with a brand kept from the log of the year before Its ashes saved through the year were supposed to guard the house from fire and lightning They were also thought to have power to heal wounds and to make animals and fields fertile

The boar s head procession goes back to when the Teutons believed the hog harbored the spirit which made corn grow At yule time they sacrificed a boar to the corn spirit' to bring good crops then ate the meat In Scandinavia today the boar is represented by little cakes or bread loaves baked in the shape of a pig In medieval England a boar s head was brought into every Christmas banquet The custom is still carried on at Queen s College Oxford

YANKS BRING SANTA TO WAR WAIFS

Wherever American forces go they make friends with the children Here Marines give a Christmas party for tiny Koreans

ANCESTOR OF THE CHRISTMAS CARD



This is said to be the first Christmas greeting card It was printed in England in 1842 and is now in the British Museum

Christmas in Art and Literature

Down through the centuries Christmas has inspired great paintings poems and stories The Nativity scene has been the favorite subject of master painters such as Fra Angelico Giotto and Sandro Botticelli Albrecht Durer portrayed it in one of his memorable engravings A superb example of the inspiration that Christmas has given to poets is John Milton s On the Morning of Christ s Nativity One of the best-loved Christmas stories is Charles Dickens A Christmas Carol

The carefully selected bibliography that follows lists many stories songs and plays for celebrating the Christmas season in school and at home

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CHROMIUM. This silvery white metal, discovered in 1797, remained largely a laboratory curiosity for more than a century. Small quantities were employed to harden steel alloys, and its many compounds found some use in several industries. But not one person in ten thousand knew about its true merits. Then, between 1915 and 1930, came its spectacular rise to a place beside iron, copper, aluminum, tin, lead, and nickel, as one of the leading industrial metals.

The long delay in its use was due to its high resistance to heat and chemicals. Extracting it from its ores by methods formerly used was both costly and difficult. But it is this same unyielding character which makes it so useful today.

Because of its toughness and resistance to corrosion, chromium might be called the "guardian metal." As little as 10 per cent of it mixed with iron or steel protects these from corrosion, producing the famous "stainless and rustless" alloys out of which thousands of articles are now made, from kitchen knives, surgeons' instruments, and watch cases to automobile radiators and roofing (*see* Alloys). Chromium plating has largely replaced nickel plating because of its superior hardness and resistance to chemical action. Ball bearings of chrome steel have been known to sustain a pressure of more than a million pounds to the square inch. Heat-resisting chromium alloys are employed for high-temperature chemical apparatus, and the chief chromium ore, called *chromite*, is used to make bricks for lining furnaces.

Chromium was named from the Greek word *chroma*, meaning color, because of the striking variety of hues it gives to its compounds. Chromium is one of the chief ingredients in mineral and metallic colors, being largely responsible for the color of many gems, such as the emerald, ruby, serpentine, alexandrite, chrome garnet, and some sapphires (*see* Jewelry), while the chromates of barium, lead, and zinc give us the pigments lemon chrome, chrome yellow, chrome red,

chrome orange, zinc yellow, and zinc green Another pigment chrome green, is much used in the manufacture of green glass

Chrome alum and chromic acid find a wide application in tanning and dyeing processes Potassium bichromate (also called "dichromate") has a remarkable effect on gelatinous solutions with which it is mixed When the latter are dried and exposed to light they become insoluble in water This phenomenon is applied to the manufacture of waterproof glues and in photography and photoengravings Care must be taken in handling chromates, for they are poisonous If they enter the blood through cracks in the skin chromate poisoning destroys red corpuscles

Chromium is extracted from chromite which contains iron and oxygen The United States leads in consumption, largely through imports California and Oregon mine some chromite Chief producers are Russia South Africa, Turkey Southern Rhodesia the Philippines Cuba Yugoslavia, and New Caledonia

CHRYSANTHEMUM When the summer flowers have disappeared and the cold winds of autumn blow the bright-colored chrysanthemum shows forth in all its glory In favorable seasons it continues to bloom well on toward Christmas

This varied flower, symmetrical or ragged prim or buoyant, straight or curled less than an inch to eight inches in diameter, streaked spotted or single-hued, ranging in color from white or yellow to lavender or deep red, is one of the most popular flowers in the world, ranking fourth in importance in the United States as a commercial flower Because of its easy cultivation the chrysanthemum can be used to advantage by amateur gardeners and is widely employed as a border plant, its propagation being secured by means of cuttings The small pompons and the immense "show" flowers are little grown out of doors for they require more care than the medium-sized ones and if left to themselves out of doors would speedily lose the special features that make them valuable Yellow and white are the prevailing colors the name itself meaning "golden flower All varieties are either scentless or have a slightly disagreeable odor

Although hundreds of different varieties, wild and cultivated are now found in all countries of temperate climate in the Northern Hemisphere the original home of the chrysanthemum was in China. From China it was introduced into Japan 2 000 years ago, and there in the 14th century after the War of the Chrysanthemums which lasted 56 years the flower was adopted as the heraldic emblem of the imperial household Today it vies with the cherry blossom in popularity among the Japanese It was brought to Europe in 1764 and later to America everywhere gaining popularity quickly The more showy varieties of mums are of comparatively recent origin, the result of skilled selection and cultivation

The chrysanthemum belongs to the family *Compositae Chrysanthemum indicum* and *Chrysanthemum morifolium* of Asia are the parent species of the Chinese and Japanese chrysanthemums of greenhouses and gardens Other garden favorites are feverfew (*C parthenium*) and marguerite (*C frutescens*)

The STORY *of* CHRISTIANITY

CHURCH, CHRISTIAN The most powerful single influence in all history has been Christianity This influence has shown itself not only in the religious beliefs and spiritual ideals of the human race, but in the march of political events and institutions as well In recognition of that fact, we divide history into the time before Christ (B C) and the time after Christ (A D, *for Anno Domini*, "*Year of Our Lord*")

Yet Christianity did not take the world by storm At the time of the death of Jesus its founder, his immediate followers numbered scarcely a hundred persons For several years after the crucifixion, the disciples remained at Jerusalem preaching and making converts with great success The new faith met so much hostility from Jewish leaders in the capital city, that the followers of Jesus withdrew to Samaria, Damascus and Antioch In these places there were many Jews among whom Peter and his fellow apostles labored (*See* Apostles)

Up to this time the new faith had been spread only among the Jews A new convert, Saul of Tarsus, afterwards the Apostle Paul, did most to admit the Gentiles (non-Jewish people) to the privileges of the new religion During more than 30 years of unceasing activity, Paul established many churches in Asia Minor and Greece (*See* Paul, Saint)

At the close of the first century there were Christians everywhere in Asia Minor By A D 150 the Roman Empire was studded with churches, a few existing even as far east as Arabia, Persia, and India A hundred years later we hear of missionaries along the Rhine on the Danubian frontier, and in Britain

Teaching as it did, a doctrine of humility and brotherhood, Christianity won most of its early converts among the poor and the oppressed When its adherents became so numerous that their refusal to worship the emperor and observe other pagan rites and customs seriously disturbed the political authorities of the Roman Empire, efforts were made to suppress them.

Persecutions of the Early Christians

Despite the tidings of "peace on earth, good-will to men" which Christianity brought to the world, the Christians suffered terrible persecution for nearly three centuries Sometimes furious mobs in the large cities attacked the followers of the new faith In addition to these occasional outbreaks were the systematized efforts of the Roman government to crush the Christians, beginning with the persecutions under Nero in 64 and Domitian in 95 Only Gaul and Britain seem to have escaped The persecution beginning in 303 under Diocletian was the last and the most severe.

Following his abdication in 305, it was directed principally against Christians in the East. They were imprisoned, lost their privileges as Roman citizens, were thrown to animals in the arena, stretched on racks, and burned during public demonstrations. Following the close of this persecution in 311, Galerius, the ruler in the East, issued an edict permitting Christians to worship as they pleased. In 313, Emperor Constantine through the Edict of Milan proclaimed the principle of religious toleration by giving every person freedom to practise the religion he preferred, and in 324 established Christianity as the state religion.

Nicene Creed Adopted

To settle questions of doctrine Constantine called together in 325 the first general or ecumenical council at Nicaea, representing the entire Christian church. At this council the Arian heresy, which denied the divinity of Christ, was condemned and the Nicene creed was adopted. This became the basis of all church doctrine from that time forward. All who departed from that creed were regarded as heretics.

While Christianity was conquering the world, its followers were grouping themselves into societies or churches. The worshipers met in private houses, where they sang hymns, listened to readings from the scriptures, and commemorated the Last Supper of the Savior with his disciples. Certain officers, called "presbyters" or elders, were chosen to conduct the services and instruct the converts. The chief presbyter received the name of "overseer" or bishop. Each church, in addition, had one or more "deacons," who visited those who were ill and relieved the wants of the poor. Thus every Christian community formed a little brotherhood of earnest men and women, united by a common faith and a common belief in their mission of spreading the gospel of Christ.

As the number of converts increased and the Christian communities gained in size and strength, important changes took place. To fulfill its mission as a world-wide institution, the Church had to wage unceasing warfare against all the forces of paganism. Hence there arose, in time, a system of church government modeled on that of the empire.

Organization of the Medieval Church

At the head was the pope—the bishop of Rome, who claimed to be the successor of St. Peter and as such to have supreme authority in matters of faith.

The people in the Church were divided into two great classes, the *laity*, or ordinary members, and the *clergy*, or officers. The latter were distinguished by shaving the crown of the head (*tonsure*) and by their distinctive dress. They were required to take a vow not to marry, known as the vow of *celibacy*. They enjoyed the *benefit of clergy*, the privilege of trial by a church court. There were two classes of the clergy, the *regular* clergy (monks and friars), who lived according to the rules (regulæ), and the *secular* clergy, those who lived in the world as bishops and parish priests. (*See* Monks and Monasticism.)

Among the principal duties of the clergy was the administration of the sacraments. These sacraments were seven in number: *baptism; confirmation;* the *holy eucharist* or Lord's Supper; *penance*, which included confession to a priest; *marriage; extreme unction* or the anointing with oil of those about to die; and *holy orders*, by which laymen were raised to the priesthood. After the Reformation, some Protestant denominations rejected various of these sacraments, most of them retaining only baptism and the Lord's Supper.

Indulgences, remitting temporal punishment for sins, were granted by the Church as rewards for good works. Offenders could be disciplined by *excommunication* or *anathema*, which cut them off from the privilege of the sacraments and perhaps even from any association with the faithful. Whole cities or countries might be deprived of the usual services of religion by the *interdict*. Persons fleeing from justice or persecution might take refuge in a church or its precincts and claim the right of *sanctuary*, or protection against arrest and violence.

The bishop was usually the most powerful figure in his locality. His church or *cathedral* was situated in the principal city of the diocese. The cathedral "chapter," consisting of members of the clergy called "canons," assisted the bishop.

Most of the monasteries kept up "annals" or "chronicles" in which the important events of each year were set down. They also taught selected youths to read and write, so that there might always be learned men to carry on the work of the Church; these were the only schools at that time. The church organizations also cared for the poor and the sick, maintaining the only hospitals and almshouses of the period.

The Great Schism of 1054

As the Church grew in power and influence, it was troubled by many disputes, within and without. There was constant friction on questions of church government with the eastern branch, headed by the patriarch of Constantinople, which refused to recognize the supremacy which the pope claimed over the entire church. This resulted in the great split or schism in 1054 of the Roman church and the Orthodox Eastern or Greek church. A number of national churches grew up within the Orthodox Eastern church, such as the churches in Russia, Greece, Serbia, Rumania, and Bulgaria. These have existed for centuries as self-governing organizations united only by common ties of faith and dogma. They have been greatly affected by the far-reaching political changes of recent decades.

After the schism of 1054, disputes arose within the Roman church on questions of faith, abuses of power and succession to the papacy. These made necessary the summoning of church councils. Among the most important of these were the Lateran Council (1215) and the councils of Pisa (1409), Constance (1414–18) and Basel (1431–49).

These disputes came to a climax in the 16th century in the great upheaval known as the Reformation which was not only a revolt against the Roman Catholic church as an organization but against many of its religious doctrines as well (*see* Luther, Martin; Reformation). Out of this dramatic religious revolution grew Protestantism, with its many diverging groups and denominations.

Growth of Protestantism

In Switzerland, the Reformation was headed by Ulrich Zwingli, who won many converts, especially in the cities (*see* Zwingli, Ulrich). John Calvin, a French priest who left the church, carried on the work of Zwingli in Geneva and clarified and organized Protestant doctrine. Calvinism, from which modern Presbyterianism is derived, became a great force in Geneva and elsewhere, particularly in Scotland. In France

the Huguenots, who took their organization and form of belief from Calvin, gained a strong foothold (*See* Calvin, Huguenots)

The reform movement in England took a different course than it did in Continental Europe In fact, it began as a diplomatic rather than a doctrinal dispute When the pope refused to annul one of the marriages of Henry VIII, the king persuaded Parliament to pass acts freeing the English church from the power of the pope (*see* Henry, Kings of England)

By the Act of Supremacy of 1534, the king became "supreme head" of the new national church This remained Catholic, however, in theology and forms of worship and did not become really Protestant until the publication of the Prayer Books of 1549 and 1552 during the reign of Edward VI Under Mary Tudor, Protestantism was checked and the English church was reunited to the Church of Rome (*see* Mary, Queens of England) Queen Elizabeth I restored the reformed church, and by the Act of Supremacy of 1559 she was made the supreme governor of the church An Act of Uniformity again established Protestant forms of worship, and the doctrine of the Church of England was formulated in the Thirty nine Articles (1576), which still remain the official statement of faith (*See* Elizabeth I)

Rise of New Denominations

Many Englishmen however desired more radical reforms, which would do away with all observances not based directly on the scriptures These "puritans" as they were called, soon broke up into groups which differed not only in doctrine but in form of church government (*see* Puritans) Among them were the Baptist and the Congregational churches and the Society of Friends or Quakers (*see* Quakers Fox, George) Presbyterianism the form of church government set forth by Calvin at Geneva was brought to Scotland by John Knox (*see* Knox) Methodism followed the economic and spiritual unrest in England during the 18th century (*see* Wesley)

After the first quarter of the 17th century the American Colonies became the scene of some of the most significant chapters in the story of Christianity Catholic missionaries in their zeal for evangelizing traversed vast unexplored areas of the New World and blazed the trail not only for their faith but also for trade and commerce (*see* Canada) The 13 American Colonies were settled in large part by various dissenting groups from England and other European countries who desired freedom to worship in their own way (*see* American Colonies, 'Mayflower', Plymouth, Mass)

By the middle of the 18th century Congregationalism was the prevailing type of church government in the Puritan colonies The Church of England had made beginnings in Virginia early in the 17th century, and after the Revolutionary War the churches of this faith developed into the independent body called the Protestant Episcopal church Before the middle of the century colonial churches had been formed by Baptists, Dutch Reformed, Friends, German Lutherans, Swedish Lutherans, Mennonites Moravians, and others Presbyterianism was brought to America by Scotch Irish emigrants in the first quarter of the 18th century

Religious Liberty Established

Although many of these pioneers had fled their native lands to escape intolerance they were not themselves always tolerant As a result the principles of religious liberty and separation of church and state were made important issues in the colonies by the zeal and courage of such outspoken leaders as Roger Williams (*see* Williams Hutchinson) Many decades passed before full religious liberty was established together with separation of church and state These are fundamental principles in the American theory of government and are guaranteed by the Constitution

One of the noteworthy first experiments in religious freedom was the founding of Maryland by Lord Baltimore in 1634 Though he was an ardent Roman Catholic as were also his two sons who carried out the plans set forth by their father they welcomed all Christian religious groups and granted liberty of worship As the frontiers were pushed back Catholicism expanded its work and by 1850 practically every large city in the United States was the center of a diocese

As a result of many separatist movements the Christian church in America is now divided into some 200 groups In addition to faiths transplanted from European soil there are many distinctively American bodies such as the Church of Jesus Christ of Latter day Saints (Mormons) organized in 1830 and the Church of Christ Scientist organized in Boston in 1882 (*see* Mormons, Eddy) Each of the Baptist, Lutheran Methodist and Presbyterian denominations has ten or more types of worship distinctively American in their origin Other organizations with large memberships are the Protestant Episcopal, Disciples of Christ, Congregational Churches of Christ and United Brethren (For these and other denominations, *see* **Adventists, Baptists**, etc, in the FACT INDEX)

The Story of Missions

Missionary zeal has always animated virtually all the branches of the Christian church Amid the religious tumults of the centuries which followed the Reformation the Roman Catholic faith was extended by widespread missionary agencies In the 17th century the Roman Catholic church created the Congregation for the Propagation of the Faith which systematized Catholic missions and established the faith in every quarter of the globe

The zeal, energy, and devotion which animated Protestant missions is well exemplified in the adventurous journey of David Livingstone into the heart of Africa (*see* Livingstone) Long before his work however, Protestant missions had been organized In the 17th century the English Quakers had a definite missionary program, and in 1701, British Protestant missions were officially centralized in the Society for the Propagation of the Gospel in foreign parts In the 18th century, missionaries had gone from Halle, Ger-

many, to the British and Danish colonies in India. By 1732 the Moravians had numerous missionaries in distant parts of the world. The most effective period of Protestant world missions began with the work of William Carey in 1793. As a result of his efforts in India, most of the large Protestant denominations formulated world programs of evangelization. The London Missionary Society was formed in 1807; and, soon after this, the American Board of Commissioners for Foreign Missions (1810), an interdenominational society, had its beginnings. All the large denominations now have world-wide missionary programs.

Efforts to Attain Unity

Among the recent important phases in the growth of the Christian church is the effort to bring about a union of the great Protestant church organizations on a common ground of church doctrine and government. The Federal Council of Churches of Christ in America is the coöperative agency for several Protestant groups. In the opinion of some churchmen it is desirable to seek a world-wide church union without uniformity. In Canada the Congregational, Methodist, and Presbyterian churches effected a plan of union under the name United Church of Canada (1925). In the United States the Christian church and the Congregational united in 1931, and various branches of Methodism merged in 1939. In other countries, especially in mission fields, efforts are also being made to bring about unity.

Moral Effects of Christianity

Throughout its history, Christianity has been not simply a set of beliefs, or a system of church organization, or a beautiful and impressive ritual of worship. Christianity has always been a moral force working for the betterment of mankind. The old classical religions made few moral demands upon their worshipers. The individual who was pious and reverent toward the gods might be a monster of wickedness in his relations with his fellow men. Christianity taught men to love God and also to love their neighbors.

The moral effects of Christianity are written large in the history of Western civilization. Manners were softened and refined by the stress laid upon such virtues as humanity, tenderness, and gentleness. Even more vital contributions of Christianity to civilization lie in its social teachings. The belief in the fatherhood of God also implied belief in the brotherhood of man, resulting in practical effort to relieve the lot of the poor, the sick, and the downtrodden, and transforming the ethical standards of the world.

The emphasis in Christian doctrine upon the value and dignity of the individual, and upon his personal moral responsibility, was a powerful factor in the development of democratic ideas and ideals.

CHURCHILL, WINSTON LEONARD SPENCER (born 1874). Once called "a genius without judgment," Winston Churchill rose through a stormy career to become England's leader in the second World War and one of the greatest prime ministers in British history.

Vigor, adventure, and prestige were Churchill's birthright. He was born Nov. 30, 1874, at Blenheim Palace, in the magnificent 21,000-acre estate of the dukes of Marlborough. His father, Lord Randolph Churchill, was the third son of the seventh duke; and his mother had been Jenny Jerome, a New York society beauty. When Winston was born, his father was chancellor of the exchequer for Queen Victoria. As Winston grew to boyhood, his grandfather became viceroy of Ireland and his father served as viceregal secretary. So Winston spent his early years in Dublin, then attended elementary schools in England.

The Redheaded Schoolboy of Harrow

At 12 he entered the army class at Harrow. A chunky explosive little redhead, Winston stayed in the lowest grades "three times longer than any one else." This did not shake his confidence in the least, and in later life he said, "By being so long in the lowest form (grades) I gained an immense advantage over the clever boys. They all went on to learn Latin and Greek and splendid things like that. But I was taught English. Thus I got into my bones the structure of the ordinary English sentence—which is a noble thing." When he was 16, he entered Sandhurst, historic British military college. There he excelled in studies of tactics and fortifications, and graduated 8th in a class of 150.

CHURCHILL—BOER WAR HERO

This is the youthful Winston Churchill as he appeared shortly after his famed escape from the hands of the Boers.

In March 1895 he became a sub-lieutenant in the 4th (Queen's Own) Hussars, a distinguished cavalry regiment. With characteristic vigor he also began to write. He spent his first leave of three months as correspondent in Cuba for the *London Daily Graphic*, meanwhile blithely serving as military observer with the Spanish forces.

The Soldier Reads the Classics

He joined a Punjab Infantry regiment in India in 1897. Between duties he devoured the works of Gibbon, Darwin, Plato, Aristotle, Schopenhauer, and Macaulay. From Gibbon especially, Churchill learned much of the sonorous, rich style which was to make him the outstanding orator of his day. In 1898 he joined the British army in the Sudan, in time for the battle of Khartoum. After being decorated for bravery, he wrote two lively books, 'The Malakand Field Force' (1898) and 'The River War' (1899).

Churchill's return to England in 1899 changed his career. Disliking his low army salary, he determined to enter politics. But when he "stood" for Parliament, the workingmen of the district voted against him as "a brash young Tory." Churchill was undaunted.

At the outbreak of the Boer War in South Africa in 1899 he obtained an assignment from the *Morning Post* as war correspondent. The rules of war forbidding correspondents to carry arms or take part in combat had not yet been established. So Churchill rode into the thick of firing at Spion Kop, Vaal Krantz and other battles. In one engagement he was captured by Louis Botha and imprisoned along with other captured officers in a school building in Pretoria. He made his escape in an extraordinarily bold manner and eventually reached the British lines 300 miles away.

BRITAIN'S INSPIRING LEADER

Upon his triumphant return to England Churchill made up for an old defeat, as he was to do so often in his turbulent life. The same workingmen who had rejected him in 1899 now, in 1900, elected him to Parliament as a hero. Before he took office he zestfully toured Canada and the United States lecturing on his Boer War experiences.

Churchill Enters Politics

In his first term in Parliament Churchill soon showed that he was to be a stormy petrel in politics. Though elected as a Conservative he showed little awe of any party leader. His friends said his politics varied with his convictions. His enemies countered that his politics varied with the trends in votes. He soon changed from Conservative to Liberal, leading the chief of the Conservatives to call him "once a young man of promise, now a young man of promises." In 1906 he was returned to Parliament as a Liberal member from Manchester.

Even Churchill's foes could not deny that he was a prodigious worker. His enormous energy carried him through a succession of offices. At 32 he became undersecretary of state for the colonies (1906–8). Two years later he entered the Cabinet as president of the board of trade (1908–10). In this post and as secretary of state for home affairs (1910–11) he worked vigorously for social legislation and spoke out boldly for home rule for Ireland.

Prepares the Navy for First World War

When England feared war with Germany after the Agadir incident in July 1911, Churchill was made first lord of the admiralty. He was ordered to "put the fleet into a state of instant and constant readiness for war in case we are attacked by Germany." From that moment Churchill drove at high speed to reorganize the navy—knocking over admirals like ninepins—to build a vigorous staff, obtaining 15-inch guns and fast battleships and developing the Royal Naval Air Service, forerunner of the R.A.F. When the first World War broke out three years later, Churchill's efficient navy became England's first powerful weapon against Germany.

But in 1915 Churchill again rammed into failure. As a war adviser he led a small group in advocating an attack on the Gallipoli peninsula in an attempt to knock Turkey out of the war. Lack of sufficient forces turned the campaign into a disastrous failure (*see* World War, First). Churchill resigned his post under sharp criticism. He then went to France as a lieutenant colonel. But wartime England needed his ability "to drive things through," and so in 1917 he became minister of munitions.

The "Wilderness Years"

The years between the first and second World Wars found Churchill gradually slipping from power. True he remained in Parliament and held several posts—secretary of war and air minister 1918–21, undersecretary for colonies 1921–22, chancellor of the exchequer 1924–29 and lord rector of Edinburgh university 1929–32. But no momentous crisis arose to whip his enthusiasm or talents. "I did quit politics entirely," he said then. "Were it not for the faint chance I shall one day be prime minister." He filled his restless time with

At the top we see Churchill as Great Britain's Prime Minister in the second World War. Below he is inspecting a damaged area of London after one of the many German air raids.

travel, painting under the name of "Charles Marin," lecturing in the United States and finishing his six-volume Life of Marlborough. His writing earned him as much as $100,000 a year.

England, exhausted by war, only called him a warmonger when he raised his voice in Parliament after the Lausanne Disarmament Conference in 1932, crying "Britain's hour of weakness is Europe's hour of danger." Political rivals dismissed it as "another of Winston's epigrams." But from the moment that Hitler rose to power in Germany in 1933 Churchill

again a Conservative, saw the challenge. With his old-time vigor, he gathered data on Germany's rearmament and tried to waken England. In 1938, when he learned that Prime Minister Chamberlain had sacrificed Czechoslovakia to appease Hitler, Churchill thundered, "You chose dishonor, and you will have war!"

Becomes Prime Minister and War Leader

War came. Chamberlain at once appointed Churchill to his old post as first lord of the admiralty. Nine months later, May 10, 1940, Chamberlain was forced to resign as prime minister in favor of Churchill.

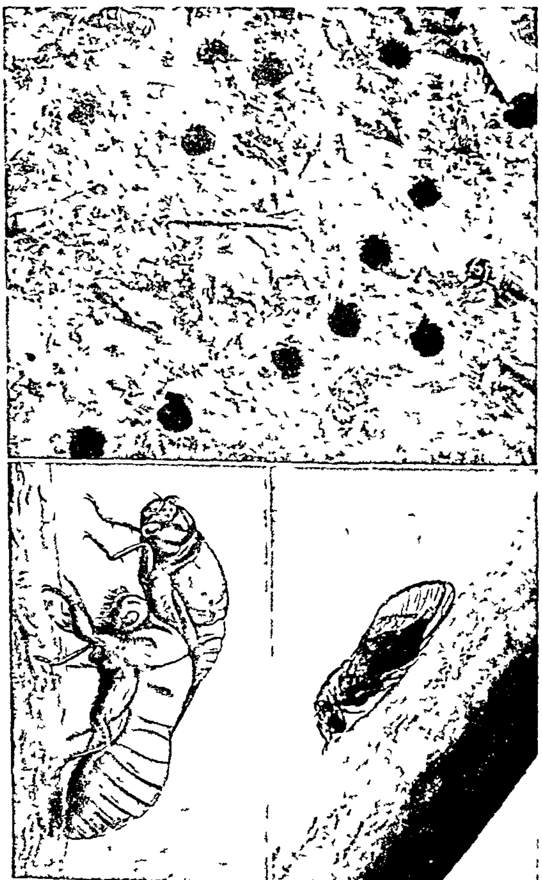
At the moment Churchill took office, the armed might of Germany was sweeping Europe Yet Churchill stood firm before the British people and declared, "I have nothing to offer but blood, toil, tears, and sweat" and then promised "to wage war against a monstrous tyranny, never surpassed in the dark, lamentable catalogue of human crime." His thundering defiance and courage heartened all England. His chunky figure, with two fingers raised in the "V for Victory" sign, became a symbol of dogged John Bull.

As the war progressed, Churchill won world recognition as strategist and statesman. Before the United States entered the war, he obtained American destroyers and lend-lease aid and met with President Franklin D. Roosevelt in 1941 to draw up the Atlantic Charter. When the United States, Russia, and China became allies, he helped plan the over-all strategy of the war.

During the war, Labor and Conservative parties co-operated in a coalition government. After the war this broke up, and Labor won the general election of 1945. Churchill entered Commons as "leader of His Majesty's loyal opposition" He continued to speak dramatically. Speaking at Fulton, Mo., March 5, 1946, he declared: "From Stettin in the Baltic to Trieste in the Adriatic an iron curtain has descended over the Continent." The words "iron curtain" became the accepted term for Russia's rigid censorship over its police-state satellites. The first volume of his six-volume history, 'The Second World War', came out in 1948; the last, in 1953 In 1951 Churchill, nearly 77, again became prime minister. He won high honors in 1953 when Queen Elizabeth II knighted him, and he was given the Nobel prize for literature. He sought international discussions on Russia and Red China. In 1955 he resigned as prime minister. Anthony Eden succeeded him. (*See* English Literature; World War, Second.)

CICADA (*sĭ-kā'da*). Seventeen years of slumber in the ground, five weeks of joyous life in the light of the sun, and then death—that is a cicada's life story, if it is one of the long-lived species. No insect is known to live longer, except perhaps the termite queen. The *nymphs*—as the cicada's young are called —drop from the tree twigs where they have hatched from eggs. They burrow into the ground, attach themselves to rootlets, and remain there motionless sucking the sap, for 17 years. Then a mysterious instinct calls them out into the light. They climb the trunk of a tree, their skins split open, and out come the mature cicadas, to make the air resound for their few weeks of life with their shrill ear-piercing song.

AFTER SEVENTEEN YEARS UNDERGROUND



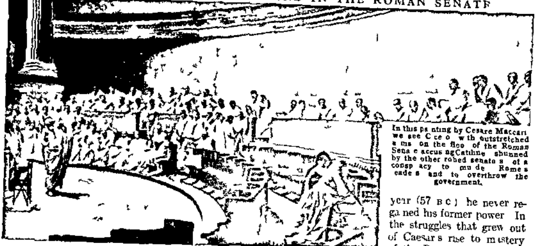
The cicada nymphs after their long imprisonment tunnel up to the surface, leaving holes like those in the upper picture. Each one climbs a tree, bursts its shell, and the mature insect crawls out as shown at the lower left. At the right is a cicada drying its wings in preparation for its first flight.

Only the males can make this noise, which led an ancient Greek to say, "Happy are the cicadas' lives, for they have voiceless wives." The noise-making apparatus is the most complicated musical organ in nature. It consists of little drumlike plates at the base of the abdomen, which are vibrated rapidly by tireless muscles.

The females do immense damage to forests and orchards by cutting row upon row of egg pockets in twigs, causing twigs and leaves to fall off One female lays from 200 to 600 eggs.

Of the 800 species of cicada, more than 100 are found in America north of Mexico. The 17-year cicada (which in the South matures in 13 years) is peculiar to the United States The commonest cicada is the black and green harvest fly, which matures in two years. Since there are two broods of this species, harvest flies appear every year. Of the longer-lived species there are 30

CICERO DENOUNCING CATILINE IN THE ROMAN SENATE



In this painting by Cesare Maccari we see Cicero with outstretched arms on the floor of the Roman Senate accusing Catiline, shunned by the other robed senators, of a conspiracy to murder Rome's leaders and to overthrow the government.

broods (17 of the 17-year and 13 of the 13-year) all accurately mapped so that it is known just where and when the next brood will appear. The 17-year cicada is often incorrectly called the 17-year locust. True locusts are grasshoppers (*see* Grasshopper).

The periodical cicada, usually green, is marked with red and black, is 2 inches long or more, with 4 wings, a wide head, a 3-jointed beak, prominent compound eyes, 3 simple eyes or ocelli, and an abdomen of 6 segments. Scientific name of 17-year cicada *Tibicina septendecim*; 13-year *Tibicina tredecim*; harvest fly *Tibicina linnei*.

CICERO, MARCUS TULLIUS (106–43 B.C.). A tall slight man with fury in his eye took his place in the Roman Senate on Nov. 8, 63 B.C. It was the silver-tongued Cicero, whose eloquence and statesmanship had raised him to the highest office in the Roman republic—the consulship. Only the day before he had escaped death at the hands of conspirators plotting to overthrow the government.

A man of great stature stalked in. His pallid cheeks betrayed the guilty fear that lurked under his insolent bearing. Cicero turned upon him with accusing finger. Then in the most famous of his 'Orations against Catiline', he exclaimed in passionate denunciation:

How long, O Catiline, will you abuse our patience? To what lengths will your unbridled audacity carry you? Do you not see that your conspiracy is known to all here? Long ago, Catiline, you ought to have been led forth to execution.

Unabashed, Catiline tried to reply, but cries of "Traitor" drowned his words. He rushed out of the Senate, but was later overtaken and slain.

Cicero was now at the height of his power, but his hot eloquence had carried the Senate too far. Some of Catiline's band had been put to death by a simple order of the Senate, a stretch of power for which Cicero was held responsible, and the "father of his country," as he had been called, was banished. Though the people welcomed his return the following year (57 B.C.), he never regained his former power. In the struggles that grew out of Caesar's rise to mastery of the Roman world Cicero played no great part. Once only, after Caesar's assassination, did he again take the center of the stage. Placing himself at the head of the republican party, he denounced Mark Antony in the famous set of speeches called his 'Philippics'. Because of these, Antony, when he came to power, had Cicero put to death.

More of Cicero's writings have survived than of any other Latin author. In his hundreds of letters to friends, including nearly all the famous people of his day, we get an intimate picture of Roman life. Mirrored also is the many-sided character of the man—great statesman, collector of books and paintings, country squire, and devoted father telling anecdotes of his only son and his darling little daughter. We also have about 50 of the speeches which made Cicero famous as perhaps the most forceful orator and masterful stylist to use the Latin language. His philosophical essays are still read by scholars for their grace and urbanity.

CINCINNATI, OHIO. For centuries the Indians used the site of Cincinnati as a favorite place for crossing the Ohio River. In 150 years white men changed it from a few small settlements into one of the great industrial cities of the United States.

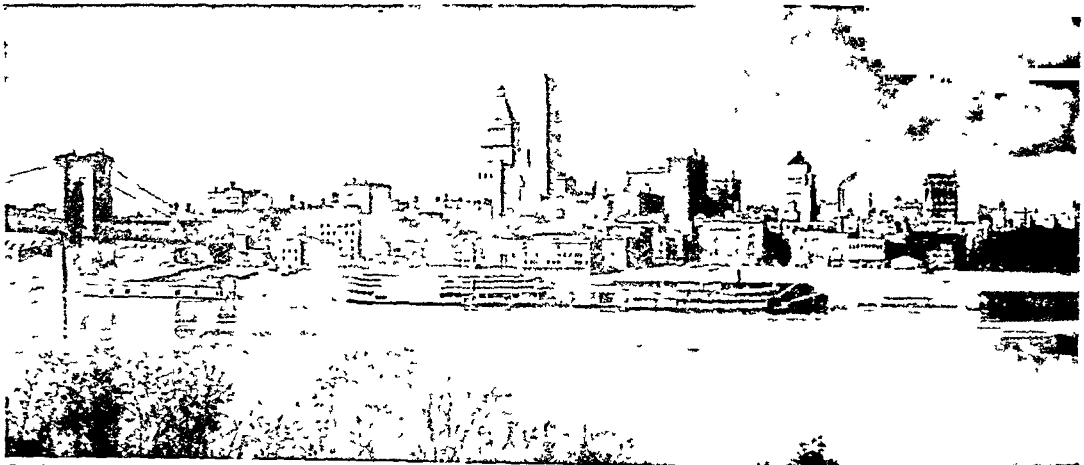
Cincinnati became Ohio's second largest city chiefly due to its favorable location. The city is on the north bank of the Ohio River midway between its source at Pittsburgh and its mouth at Cairo, Ill.

After 1811, when the first steamboat chugged down the Ohio, Cincinnati became one of America's greatest inland ports. The city grew so rapidly into a busy metropolis during the middle 1800's that Longfellow called it the "Queen City of the West."

Today Cincinnati is a leading transportation center. Eight railroads operate 20 trunk lines into and out of the city. It is served by seven federal highways and by three transcontinental air lines. It has two large airports, Lunken Airport in the valley of the Little Miami River and the Greater Cincinnati Airport across the Ohio in Boone County, Ky. Barge lines go as far as Pittsburgh and New Orleans.

Rich farming lands and coal resources near by also helped make Cincinnati outstanding in manufacturing

A NORTHERN CITY WHICH FACES DIXIE LAND



Cincinnati's industrial and business districts are seen from the Kentucky side of the Ohio River. The city gained importance in pioneer days from the heavy river traffic. Later it became a great railroad, trade, and factory center.

The city was the leading hog-packing center of the nation (it was nicknamed "Porkopolis") until the invention of refrigerator cars enabled cities farther west to ship meat products to the East Today the Cincinnati metropolitan area (Hamilton County, Ohio, and Campbell and Kenton counties, Ky.) has about 1,700 manufacturing plants Leading products include foods and beverages, chemicals and soaps, fabricated metals, machine tools, and printing and publishing.

Cincinnati is also a busy commercial center. It carries on a large volume of trade within its limits and with many other cities. It is a distributing center not only for east-west trade but also for the growing north-south traffic. The city is linked with the South by five bridges which cross the Ohio River to Covington and Newport on the Kentucky side.

A City of Hills

The factory and business districts of Cincinnati lie in a basin near the river. Dominating the basin is the 48-story Carew Tower, with its hotel, offices, and department stores. The tall, bronze Tyler Davidson Fountain, cast in Munich in 1871, gives an Old World touch to Fountain Square. To the west, near Mill Creek, is the massive Union Terminal, an excellent example of modern railroad station architecture.

From the business section the land rises in a series of low terraces, 50 to 150 feet above the river. Arching behind these plateaus are hills, 300 to 500 feet above the river level. Residential areas spread around and over the hillsides. Some of the hills have been made into beautiful parks. The most attractive are Eden, Alms, and Ault parks.

A Cultural and Educational Center

Cincinnati is noted for its development of music, art, and education. Its symphony orchestra is one of the nation's finest. The Zoölogical Garden is the setting for light and grand operas during the summer. A May music festival, held every two years, singing societies founded by the Germans, and its College of Music help give the city its reputation as a musical center.

On Mount Adams, in Eden Park, is the Cincinnati Museum of Art and its associated Art Academy. Near the park are the famous Rookwood Potteries, which produce handmade artwares. The Taft Museum is city-owned. The building was erected in 1820 and presented to the city in 1932. It houses a notable art collection, including the work of Frank Duveneck, who was a resident of the city. Here William Howard Taft was formally notified of his election as president of the United States in 1908.

Educational institutions in the city are the municipally supported University of Cincinnati, founded in 1870; Xavier University, maintained by the Jesuits, Mount St. Mary of the West; and the Ohio Mechanics Institute. The Hebrew Union College is the oldest and largest rabbinical seminary in the nation.

Early History of the City

In 1788 Benjamin Stites and a party of 26 men, women, and children drifted in flatboats down the Ohio from Limestone, Ky. One mile west of the mouth of the Little Miami River they founded a settlement which they named Columbia. Six weeks later Robert Patterson and a group of men built a village a few miles downstream which they called Losantiville.

The next year, 1789, the settlers completed and garrisoned Fort Washington to guard against attacks by unfriendly Indians. When General St. Clair arrived as governor of the Northwest Territory in 1790, he renamed the place Cincinnati in honor of the society of that name (*see* Cincinnatus). The town became an outfitting point for pioneers going west.

From 1845 to 1900 Cincinnati was the southern terminus of the Miami and Eastern Canal from Toledo on Lake Erie. In 1869 the city built its own railroad, the Cincinnati Southern to Chattanooga. This is the only municipally owned railroad line in the country.

City-manager government was adopted in 1924. Nine men, elected by proportional representation, appoint one of their number as mayor and hire a city manager. Population (1950 census), 503,998.

CINCINNATUS Lucius Quintius (born about 519 B C) Rome was in danger An army of Aequians from the mountains to the east had marched into Roman lands and was burning and plundering the countryside The defending army was encircled and apparently doomed In desperation the Senate turned to Lucius Quintius called Cincinnatus (meaning "curly haired) To this patrician or nobleman came messengers with the news that he was appointed dictator—supreme ruler for as long as the crisis should last They found him quietly plowing his fields

Immediately Cincinnatus left his farm and hurried to Rome He led a new army in an all night march to the camp of the Aequians and in a single battle (458 B C) defeated them decisively Soon after the victory he laid down his power and returned contentedly to his farm Only once, almost 20 years later, did he return to public life—again at the summons of his country, this time to oppose the usurpation of power by a Roman knight Spurius Maelius

At the close of the Revolutionary War George Washington and other officers formed the Society of the Cincinnati named for Cincinnatus whose example they followed in returning to civilian life Lord Byron called Washington ' the Cincinnatus of the West "

CIRCE (*sėr'se*) In Greek mythology, a power as dire as that of witches belonged to a woman of rare beauty Circe who was said to be the daughter of the sun god Helios and an ocean nymph Perse By means of drugs and spells she could turn men into swine and other beasts Perhaps the stories told about her magic were meant to teach that men are oftentimes changed into beasts by yielding to base temptation From her name has come the word Circean used to describe anything that leads by subtlety and charm to moral degradation

Circe dwelt on an island Aeaea on the coast of Italy to which she had been banished by her father for murdering her husband the Prince of Colchis How Odysseus (Ulysses) and his companions were blown to her shores and what befell them there is one of the classic stories of ancient literature as it was told by Homer in his epic poem the 'Odyssey

(See Homer Odysseus)

Homer s Story of Odysseus and Circe

According to Homer s story jealousy and greed brought disaster upon the companions of Odysseus when they were already in sight of Ithaca their native land for which they had so longed during their ten years of fighting before Troy To assure them a speedy homeward voyage Aeolus god of the winds had given Odysseus all the contrary winds bound in a bag Then he sent the gentle West Wind to waft the travel worn adventurers to their island home

For nine days Odysseus held the sheet while the ship drove steadily on When they were almost home—in sight of the beacon fires of Ithaca—he fell asleep His men had been eyeing the mysterious bag Look! ' they muttered we are returning empty handed while Odysseus has much goodly spoil And now Aeolus has given him this bag of wealth Let us open it and see how much gold and silver it contains

So they cut the bag open and instantly the winds rushed out in a furious storm that drove them back to the island of Aeolus Begone! blustered Aeolus It is clear the gods hate you

Heartsick they put out to sea again and were driven by contrary winds to a beautiful island Seeing smoke curling up from a wooded hill Odysseus sent his kinsman Eurylochus with half his men to discover who lived there

In the wood they found a marble palace guarded by tame lions and wolves who fawned upon them like dogs Within sat a lovely fair haired lady weaving at her loom and singing sweetly It was Circe With kind words and a warm smile of welcome she invited the strangers into her palace

The others went in but Eurylochus fearing trickery stayed outside Within the shining doors Circe feasted the men on cheese and barley meal and yellow honey with wine and slyly mixed drugs with the food to make them forget their own country When they had eaten the sorceress smote her guests with a wand and lo! they turned into swine They had the bristles the shape and the voice of swine but their minds were unchanged Thus they could realize how low they had fallen Their grunting sounded almost like sobbing as Circe scornfully drove them into pigsties and flung them acorns to eat

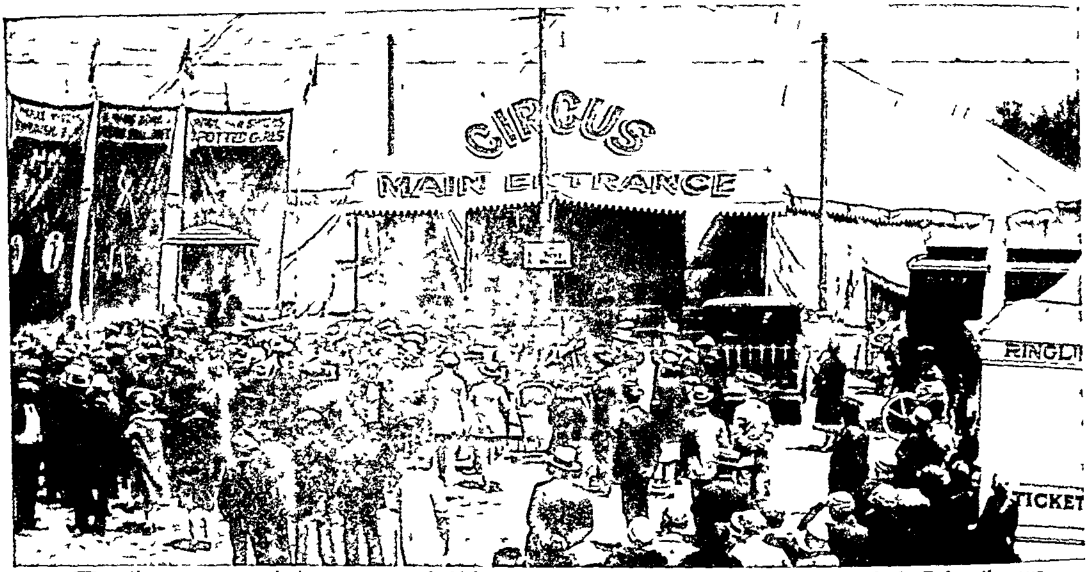
How Odysseus Fared Against the Wiles of Circe

Eurylochus horror-stricken at the sight fled to Odysseus with the dreadful news of what had happened to his men Odysseus whipped out his sword and strode alone through the charmed wood to the palace of Circe The enchantress welcomed him and gave him the magic drug in a cup of gold He drank deeply of the potion. Circe smote him with her wand and bade him join his comrades but he did not turn into an animal Circe fell on her knees thinking Odysseus a god for no mortal had ever before withstood her sorceries But Odysseus was protected against her magic by the white flower of the *moly* a plant sacred to the deities Hermes (Mercury) the messenger god who wore winged sandals had overtaken Odysseus on the way and given him the flower

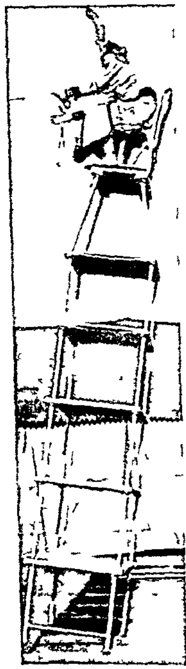
Circe now turned her arts to the service of Odysseus She changed his comrades back into men and treated them with so much kindness that they dwelt there for a year in luxury and pleasure The only thing she refused them was to let them go

At last because Odysseus became sad with longing to see his wife Penelope and his son Telemachus Circe consented to let him depart But first she made him visit the land of the dead from which no mortal had returned After hearing prophecies that were to be fulfilled he came back in safety Thereupon Circe filled his galleys with bread and meat warned him of dangers that lay ahead and told him how to avoid them. And finally standing on the shore with her nymphs she bade him a sad farewell

WHEN *the* CIRCUS *Comes to* TOWN



When the circus comes to town, young and old hurry out to the lot where the "big top" is pitched. Before the main gate opens for the real performance, the people crowd into the side shows or visit the animals in the circus menagerie.



CIRCUS. It's always Circus Day somewhere or other. In winter, when our big circuses are supposedly sleeping—though they really are not—the circuses of Europe are doing their biggest business. That is very gratifying to circus performers, for they can leave America after the long summer and fall season and hurry to the continental cities. There they perform in what might be called stationary circuses housed in buildings, such as the Mills Circus in London or the *Cirque d'Hiver* in Paris. Even in America today the children can see the clowns, the trapeze artists, and the animals perform the year round, since television has brought the circus to the home-receiver screen.

The circus under the "big top" is distinctly an American invention, though of European descent. With all its Americanism, it has certain features which continue, year after year, to link it to ancient history. For the circus is one of the oldest amusements. Even 2,000 years ago, the circus was so old that the Romans did not know when it began.

The Circus of Ancient Days

The Roman circus was an open-air structure for chariot races and other amusements. The largest and oldest was the Circus Maximus (biggest circus). This was in a long, narrow valley, with seats built on the sloping sides of the hills. For several centuries the seats were of wood and had to be rebuilt frequently. Julius Caesar rebuilt it partly in stone, making it large enough to hold 150,000 spectators. Later emperors improved it, until in the time of Constantine, 16 centuries ago, it is said to have held 385,000 people. Chariot races, which are still a feature of our modern circus, were the main events, with feats of horsemanship, tumbling, and rope dancing in the intervals. So fond were the Romans of this amusement that they had several great circuses in or near Rome. As their legions conquered Asia Minor and North Africa and Spain and France, the Romans who went to live in the conquered provinces built other circuses. The ruins of some of these are still standing.

That is how the love of the circus spread. When Rome declined under the assaults of warring northern tribes, the old circuses became a thing of the past. The circus instinct remained, in wandering troupes of performers, in horse fairs, in street-corner entertainments by roaming beggars who found that a captive bear or trained pig or performing dog would gain them more money than mere requests for alms. Thus the spirit

Eager boys sometimes get a chance to see a tumbler or a clown acrobat practising his act in the open air outside the tent.

was kept alive until at the end of the 18th century an English cavalryman Sgt Maj Philip Astley founded the modern circus in London His first programs included only feats of horsemanship but he soon added acrobatic acts and even a clown Astley s sl ow was a tremendous success and soon he had many imitators

Beginnings in America

One of these was John Bill Ricketts, who went to the United States and settled in Philadelphia There he opened a circus like Astley s—that is a show held inside a building in which horsemanship was featured Perhaps it is due to the Astley influence that Europe still likes its circuses in permanent buildings although there are a few big shows which travel in the summer like the American circus

John Bill Ricketts won the friendship of George Washington who attended his show and recommended it The resulting popularity caused otl er showmen to appear in New York Boston and even in Washington Ho v ever progress was slow for a time In the first place there were few cities then with a population large enough to support a permanent circus In the second place the United States apparently needed something more thrilling and unusual than horses This came in 1815 when Hackaliah Bailey a farmer of what is now Somers N Y bought an African elephant from his brother a ship captain who had brought it to America The elephant was named Old Bet and she might well be called the mother of the American circus

Because of her a whole tr be of circus men came into being and American circus history has ever since centered largely about the elephant A big show is often ranked not by the number of its railroad cars its people its performers, or by the size of its tent but by the number of its elephants

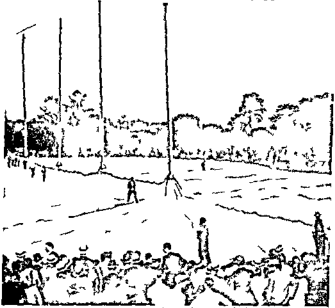
Hackaliah Bailey made a small fortune by tramping around the country with Old Bet People would often line the road at night in the hope of seeing the gray hulk of the immense bea t as she shuffled past in the darkness Old Hackaliah being a canny Yankee always traveled from town to town during the darkest hours otherwise in those shrewd and penny-saving days his patrons would get a free look Old Bet was such a mint for him that when she d ed he built a monument to her which still stands at Somers and with his profits he built a hotel which he called the Elephant House Of ourse as his success grew Bailey had acq ured other attractions—as well as many competitors Every adventurous young man around Somers wanted to be in the circus business They came from all walks of life One was a cobbler Another was a farmer s son Another was a butcher

There was also a young clerk who had a flair for extravagant language With him everything was the biggest thing on earth He knew how to use exaggeration in such a way as to get the interest of newspapers and through this he finally became known as the greatest showman in history His name was Phineas T Barnum You have seen his picture many times when the fences and barns and billboards of the countryside have been covered with the posters announcing the coming of the Ringling Bros and Barnum & Bailey Combined Circus the Biggest Show on Earth (*See* Barnum Phineas T)

Rise of Barnum and the Ringlings

The truth is Barnum was a better advertiser than he was a showman for he ran in and out of several fortunes However he was so good at publicity that the best circus brains in the country were eager to be his partners One of them was a man who had started

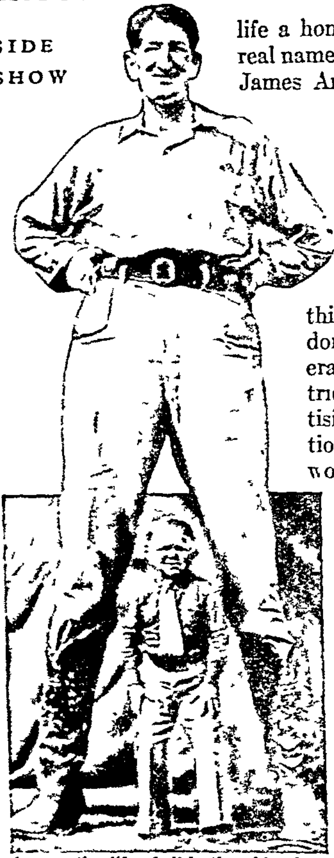
HOW THE BIG TOP IS PUT UP



Great poles fit th ough openings in the t emendous spread of canvas The cables that hold the po es steady a e stretched in a l d ec ons and fas ened to g ant stakes Then the tent s ho sted nto pos t on and ts s des are guyed and staked

The true vo ce of the ci cus s the w d b a ng mus c that comes from the cal ope s b assy throat

SIDE SHOW



Among the "freaks" in the side show are the giant, 8 feet 6 inches in height, and the midget, 29 inches.

life a homeless orphan. His real name is said to have been James Anthony McGinness, but when he went into the circus business, he took the name of Bailey. Thus, Barnum & Bailey should really have been Barnum & McGinness; but this would not have done at all, since alliteration is one of the pet tricks of circus advertising. Every description must have several words beginning with the same letter—like "Pounds of Ponderous Pachyderms," or "Death-Defying Demons in Daring Deeds of Dexterity"!

An elephant gave Barnum & Bailey its greatest reputation. The biggest elephant then in captivity, he had been bought from the London Zoo by Barnum and renamed Jumbo. Jumbo got such wide publicity that, even though he has been dead more than 50 years, his name still lives as a word for anything remarkable for bigness.

While Barnum & Bailey was rising to fame, seven brothers in McGregor, Ia., saw their first circus, a small affair carried on a river boat, and decided that they wanted to become circus men. Their name was Rüngeling, and they were the sons of August Rüngeling, a Bavarian harness maker. Their first shows were held in their father's barn in Baraboo, Wis., to which the family had moved. The admission price was two pins. Gradually they improved until their show was worth ten pins a performance and at last a penny. Unlike most boys' shows, this was not a mere matter of a few days' fun; the brothers were in deadly earnest about it. And no matter how much the oldsters laughed, the youngsters kept at it. One could play a cornet, another a violin. Another could sing. A fourth thought he was a dialect comedian. By saving their pennies, they bought a goat, then a pony, then a horse or two, and their admission price rose to ten cents. At last five of them took to the road with a sort of vaudeville show. When they had made sufficient money, they changed to a horse-drawn circus. After a time they changed their name to Ringling. As the years passed, they absorbed the Barnum & Bailey Circus as well as many others. At one time, John Ringling owned every big show in America. All the Ringling brothers now are dead and the circus is run by a corporation mainly owned by relatives.

We Visit a Modern Circus

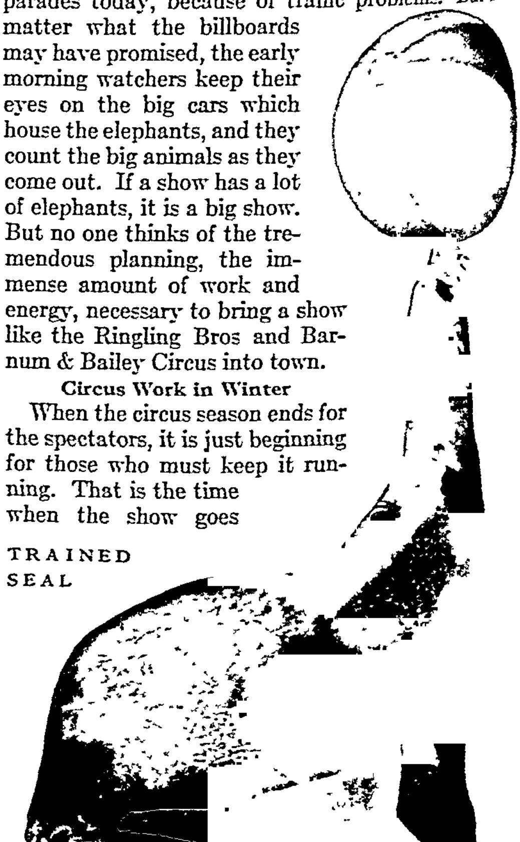
And now, suppose we take a trip to the circus itself. After all, the best way to know a thing is to see it.

As most of us think of it, a circus merely "comes to town," arriving mysteriously, in the gray of morning from some unknown point, setting up its tents, giving its shows, and then departing, as it came, in darkness. Everything moves so smoothly that it seems to work by magic; perhaps it is this seeming magic which has given the American circus much of its lure. There are few boys who have not counted as one of their great experiences the morning they got up to "see the circus come to town." And no matter how old or how young the watcher may be, there is one thing he always looks for. The show may have promised hundreds of performers. It may have promised five rings and three stages, and even a "grand, glittering and gorgeous street spectacle three miles long"—although this hardly can happen since only the smaller shows can give parades today, because of traffic problems. But no matter what the billboards may have promised, the early morning watchers keep their eyes on the big cars which house the elephants, and they count the big animals as they come out. If a show has a lot of elephants, it is a big show. But no one thinks of the tremendous planning, the immense amount of work and energy, necessary to bring a show like the Ringling Bros and Barnum & Bailey Circus into town.

Circus Work in Winter

When the circus season ends for the spectators, it is just beginning for those who must keep it running. That is the time when the show goes

TRAINED SEAL



Because they can be taught to juggle, because they waddle comically and bark noisily, sea lions are always circus favorites.

THE PRETTY LADY ON THE ELEPHANT

When the grand march circles the big tent among the gorgeous ladies riding by you can find the Queen of Sheba Cleopatra Marie Antoinette and a host of beautiful princesses and winged fairies like this one

nto winter quarters which may be in any locality where conditions suit the owners The Ringling show winters in Sarasota Fla while another show owned by the same corporation spends the winter months in Venice Calif on the other side of the continent

Winter is a season of intense activity The performers have scattered Some have gone to Europe Others run chicken ranches and filling stations Others go into unit shows in picture houses or into motion picture work Many clowns add to their earnings by appearing in big department stores at Christmas shopping time Only the animal tamers the horse trainers the executive staff and the skilled workmen remain at winter quarters For them there is much work

The railroad cars which transport the show must be repaired and repainted Big circuses own all their rolling stock except the engines A small railroad show has about 30 flat cars stock cars and sleepers the largest has about a hundred 70-foot cars Every show wagon must be gone over every cage repaired every freight wagon made ready for a season of pounding about the country often mounting to a total of 17 000 miles New tents must be made Sometimes these are purchased from tent companies and sometimes they are made on the grounds When one considers that the main tent or big top of the Ringling show covers more than three acres of ground one can realize the tremendous job of making such a tent In addition there are the side-show tents the dressing tents the horse tents and the tents for the cookhouse and blacksmith shops all of which must be renewed at least every other season Then there are the costumes

All winter long in a great building seamstresses are at work making the costumes There are rhinestones by the bushel brilliants by the thousand pounds spangles by the thousand gross—but none of the tinsel which most persons associate with the circus Tinsel is for Christmas not for circuses it is too fragile Only materials of the strongest type which means the finest —can stand the hard usage of a circus season Therefore the velvets the satins the plushes and silks and serges and broadcloths which you see in a circus performance are the most costly on the market purchased as much for wearing qualities as for show The spangled blankets worn by the elephants and camels and horses are of extra thick velvet and may cost hundreds of dollars apiece

Every tent stake must be repainted and resharpened every tent pole examined for defects All harness must be gone over Meanwhile in the animal houses all performing animals must continue their schooling lest they forget their lessons from one season to the next

Getting Ready for The Road

March is a busy month Not only are the final touches being given to the equipment but last minute arrangements are being made by the executive staff for taking to the road in April All winter scouts have been touring Europe in search of novel acts for the circus changes from year to year although the framework remains

—AND JOCKO FOR CONTRAST

No march would be complete without an orang or a chimp on a young elephant

the same. In a circus there is as much excitement over a new and thrilling act as there is in a home when a new baby arrives.

Now the press agents are writing their material for the newspapers. Posters are being printed and stacked in the various advertising cars. Big shows often send three advertising cars ahead of the show, a week apart. These carry posters by the ton, and crews of billposters, lithograph men, and bannertackers, who cover every available bit of space within miles of the show place. Added to these men are contractors who buy food for the people and the animals, lease the showgrounds, pay the license fees, and attend to half a hundred other details which must be arranged beforehand. Where, for instance, would the elephants get their water if a contracting agent had not made arrangements for it to be supplied from a fire plug? With one circus carrying more than 40 elephants these days, the small boy's job of carrying water to the "ponderous pachyderms" ended long ago. But the small boy has his job, nevertheless.

Every show carries what is known as a "punk boss." He is the man who hires boys, or "punks," as the circus people call them, and has them on hand for work when the show arrives. They help carry canvas, seat planks, and other materials, and they receive free admission tickets as wages. The regular workmen put up the show. These are the "razorbacks" who unload the train, the "skinners" or teamsters, the "pony punks" and "led stock men" who look after any animals which can be haltered, the "bull" or elephant men (all elephants, male or female, are "bulls" in a circus), the animal attendants, the canvasmen, the pole men, the seat and plank men, and "roughnecks" or general laborers. Performers do not help put up the show. Their job is to superintend the setting of their own rigging by "property men."

HIS MAJESTY—THE CLOWN

Hot and hard-working in his grease paint and fantastic costume, the beloved circus clown "carries the show" between the bigger acts.

But, first, to get to a town, a show must have a route. Planning this is another part of the March activity. A show cannot profitably make more than a 100-mile journey in a night; hence the general agent and the general manager who route the show must be geniuses at geography. They also are alert to business and farm conditions throughout the country and have studied the weather for various sections over a period of many years. Hence they know what average of weather to expect, they know whether a community is prosperous or poor, and they know exactly by which railroads to get into a town and by which to leave. A show train is dispatched on a railroad as a "circus special" with its own schedule. Ahead of the train travels the "twenty-four-hour man." He got the name because he is supposed to precede the show by twenty-four hours. He deserves it because he often works day and night. It is his duty to check on everything done by the hundred or more men who have gone before him; he must see that food and feed are waiting, that unloading conditions will allow the circus to get to the lot as soon as possible.

The Circus Gets to Town

So now the circus is in town. And with the circus tents erected, the gates open "twice daily, rain or shine." But to reach them we must pass the ticket wagons, the "juice joints" or lemonade stands, and the "kid show" or side show. There's a line of customers in front of the various ticket wagons. The ticket sellers handle money with both hands, seeming to throw all currency on the floor. They are really tossing it into wicker baskets; they must work so fast that there is no time for them to place it in drawers. People are in such a hurry to get to the circus that they annually leave hundreds of thousands of dollars in change behind them at the ticket wagon. But the police system of the big circus is so efficient that a person rarely loses the money he has left behind.

Here are the vendors who sell pop and cotton candy. Once there was pink lemonade, but pure food laws helped end that, plus, of course, the story of how pink lemonade started. The story is that a "juice joint" vendor accidentally colored a barrel with the dye from his performer wife's red tights. It made such a hit that pink lemonade was a circus custom for years.

And now, the side show—the side show-w-w-w! Don't feel sorry for the freaks. Many of them look upon themselves as normal and the rest of us as monstrosities. Nearly all of them are there because they truly like the life, realizing that it gives them more comfort and money than anything else they could do. Every circus is besieged by applications from freaks of all kinds. However, the most remarkable "queer and unusual pee-pul" sometimes come to the show quite by accident. A few years ago, one of the bigger shows was without a giant. In El Paso, a tremendous youth, nearly eight feet tall wandered upon the lot and asked if he could have a free ticket to the side show. He said an "amateur freak" should be allowed to meet the professional ones without charge. The side-show manager, alert to business, backed the young fellow against a property wagon and sent a workman aloft to lower a tape measure. The

HEROES OF THE HIGH TRAPEZE

A lifelong training goes into the really dangerous work that these flying aerialists do with their trapezes high up under the roof of the tent. They rank among the aristocrats of the circus

visitor's height was 7 feet 10 inches.

"But I'm still growing," he said. "I'll be taller than that."

"And you'll be with the circus," the manager answered. "Let's talk business."

Thus instead of merely going to the side show the giant joined it and is still happy over his bargain.

Now let's go into the big show. There are four gateways and through them in the biggest circus more than 20,000 persons a day may flood. Often a circus plays to a greater population than that of the entire county in which it shows, drawing people from as far away as a hundred miles. More than 25 million persons a year travel through the gates of our circuses, thus making the business one of the biggest amusement enterprises in the United States.

Through these gates go profits or losses which run annually into the millions, for there are about 30 shows on the road today. This is fewer than in the most crowded days, but the big ones are now bigger than ever. Most circuses are motorized shows traveling in trucks and trailers. Some date back to "mud show" days before the advent of the automobile, when road shows traveled by team and wagon. At least one circus name is 100 years old, while others run from 25 to 50, having piled up fortunes for various owners. The profits of the biggest shows often run to more than a million dollars for a season.

Among the Circus Animals

Well, here we are through the gates and into the menagerie. Wild beasts and horses were the chief attractions of the old Roman circuses. The same is true today. More than any other agent the circus has given our young people a knowledge of zoology by taking exhibits of wild life into villages and hamlets. It brought the first giraffe, the first hippopotamus, and the first rhinoceros to America.

THE LEADING LADY

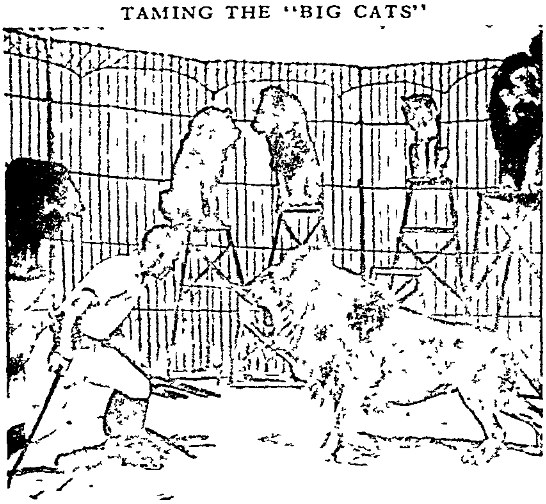
The star equestrienne and her white high school horse are at the very top of the circus world

Circuses get their animals from many sources. Captains of tramp steamers touching at jungle ports often make money on the side by bringing in animals. The Hagenbeck Brothers of Germany for many years supplied circuses and menageries as well as zoos all over the world. Today there are many other dealers in wild animals.

Many circus animals are costly. A tiger may cost $1,500 or more. Good circus elephants bring from $3,000 to $10,000 and are worth every cent of it, since the whole circus centers about the elephant. No human agency, for instance, can test a weak bridge so quickly or so efficiently as a wise herd queen or leader who merely presses one foot on the structure and knows at once whether it is strong enough. The elephants haul material to the circus grounds and haul it back at night. When a wagon gets stuck in mud and horses fail to budge it, the "working bulls" can push it out with their great heads. In the morning they put the wagons in place on the circus lot. At night they push them out and place them in readiness for teams to haul to the railroad yards. If a switch engine is not handy, they can move a railroad car. And of course they are the center of attraction in the menagerie.

Elephants are the only wild animals that stay with a circus because they love it. No ordinary means can hold an elephant

TAMING THE "BIG CATS"



The lion tamer is one of the specialty headliners of the modern circus. He performs such thrilling feats as directing a large mixed group of lions and tigers in the same cage. His best defense is a plain chair held with the legs toward the animal's face.

which wants to get away. These animals like to be with people, and they like the candy, apples, peanuts, popcorn, and other treats that come to them daily.

Inside the Big Tent

As we go into the big tent a whistle sounds. "Tournament," the opening spectacle, is just beginning. That whistle will sound many times during the show, for a circus runs by the whistle of the director. It is the mainspring of the performance, just as the band is the clock of the circus. A workman on the lot can always tell the time of day by the music the band is playing. He knows that certain musical numbers are for certain acts and that these acts are due at a definite time.

If you want to see a circus properly, do not try to watch all the rings and stages but center your attention on one place. You will see everything. The purpose of having several rings and stages is not to present a wider variety of acts but to give everyone in the tent a chance to see well. Some of the big tents are nearly two blocks long, so there must be some duplication. Thus three riding acts go on at one time, two or three aerial acts, and so on.

Everyone thinks of the clowns as a leading circus feature. Strangely enough, however, the clowns are important to the circus largely as a "cover-up." They flood into the arena and take the attention of the audience from the fact that the rings and stages are being made ready for other acts. In former years, a circus was built about a chief clown who cracked jokes and sang. That time is past, due to the largeness of present-day shows. Now the clown is usually just a living cartoon exaggerating everyday manners and customs. No longer is a clown paid $1,000 a week. Their salaries now run from $75 to $500 a week.

Aristocrats of Circus Life

Now we have gone through the tent and reached what is known as the "back door," where performers await the whistle for their act. There is a well-defined social scale among the members of the circus. Contortionists form the lowest rung of the ladder; horseback riders, members of flying acts, and star wire walkers are at the top. Salaries for these sometimes run as high as $1,000 a week.

More and more the American circus is coming to depend on Europe for its performers. Few American boys and girls are willing to undergo the strict discipline and rigid training necessary to the making of a good performer. A true circus "kinker" must be trained from babyhood; it is nothing for a three- or four-year-old circus baby to be able to turn flip-flaps and somersaults. Circus performance is largely a matter of tradition, with boys and girls growing up to take the place of their elders. As a result the American performer is giving way to acts imported from countries where the old family discipline is maintained.

How Circus People Live and Work

All performers except the stars do more than one act. They are usually employed under contracts which call for them to be "generally useful." and some appear in as many as seven or eight different routines. A girl, for instance, may "ride manège," which means the handling of "high-school" (highly trained) horses, and also "dress" the elephant act. The latter means that she seems to train the elephants, while the real work is done by male attendants working with her. Another girl may be on a flying ladder in one act, in a tumbling number in the next and on a perch, or tall pole, in another.

The performers dress together in a great tent, divided into halves for men and women. Trunks are set in long lines, with a clothes hanger and a pail of water before each trunk. The performers sleep in specially constructed railroad cars, going to hotels only when the show halts on Sundays. They eat in a great tent known as the cookhouse. Even the stars eat here, and the food is excellent. In the biggest shows more than six thousand meals a day are served. The stars may have individual tents or they may have dressing rooms fitted up in wagons.

On trains the stars have staterooms with many conveniences. When Lillian Leitzel, an aerialist known as the queen of the circus, was alive, her train quarters were large enough to include a baby grand piano. Every big show carries its doctor and nurse, and at least one has a hospital car equipped for major surgical operations.

Many popular notions about the circus have no foundation. It never splits up, one part going to one town and the rest to another. It does not take money out of a town, because it draws persons from miles around who spend part of their day shopping. Its elephants do not hate persons who feed them chewing tobacco, because they like a certain amount of it. Circus people do not kidnap boys and girls; it is harder for a child to join a circus than to become president of a bank. It does not carry thieves and cutthroats but has its own police department to watch out for bad characters. Finally, it does not leave town

BEHIND THE SCENES WITH THE CIRCUS PEOPLE

The harness makers (left) are busy from dawn to dark repairing and cleaning all the equipment needed by the circus animals

In the dressing tent (right) each performer's trunk does duty as a dressing table, clothes closet and chest for all belongings

as soon as the night performance is over, but starts away from town before the evening show is well started.

A Marvel of Efficiency

The big show, in fact, begins to leave at dusk, along a path marked by torches to what are known as the loading runs. First the cookhouse is packed as soon as dinner is over—dinner begins at 4:30 P.M. Then the horse tents are packed. As soon as the performers finish with rigging and properties these are loaded and sent away. By the time the opening tournament starts around the hippodrome track of the big show the menagerie tent is being lowered, and long before the various cages have been started away. The elephants are the last menagerie animals to leave the lot, departing as soon as their act in the big top is finished. By the time the big show is over one complete train, known as the Flying Squadron, already has been loaded and often is on the way to the next town.

This is why the circus seems to appear and depart so magically. It is a marvel of efficiency. In addition circus people understand the value of cooperation in a way that would be difficult to match. They are clannish and aloof toward outsiders, but among themselves the principles of give-and-take and of the helping hand are universal rules.

The Cousins of the Circus

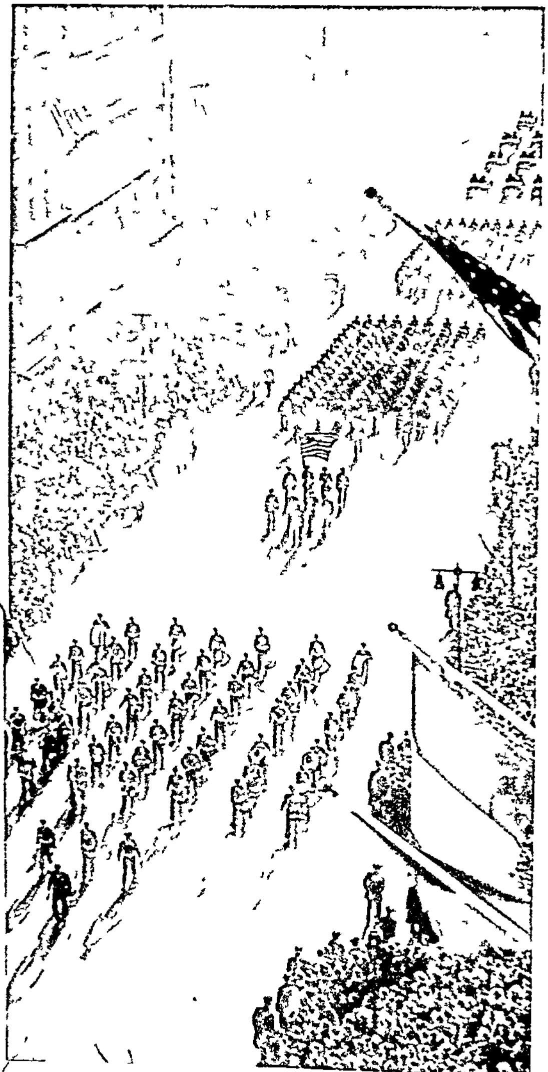
Small relatives of the big circuses are the numerous dog and pony shows, traveling menageries, and troupes of acrobats that used to tour the countryside in wagons and now travel by automobile trucks and trailers. They seek out county fairs where they hope to find ready made audiences without having to pay advertising costs. Larger and more impressive cousins of the big general circuses have been the Wild West shows, such as the famous one started by Buffalo Bill in 1883 (*see* Buffalo Bill). He undertook to dramatize American frontier life by acting out battles with Indians, cavalry charges, adventures of Pony Express riders, and stagecoach holdups. He mixed in exhibitions of skill in shooting, roping, riding outlaw horses, and other work typical of the old buffalo-hunting and cattle-raising days. His show and a few others that grew up in imitation of it won tremendous success in Europe as well as in all parts of America.

Waiting at the "back door" of the big tent for the whistle that calls them on are jugglers, strong men, and circus Cossacks

The circus dining room is the cook tent where the whole army of circus people assembles three times a day to eat.

Rodeo shows came later. These were derived from such local celebrations as Cheyenne's famous Frontier Days, in which men who actually worked on the range competed for riding and roping prizes. As the popularity of these contests grew and prizes increased, professional contestants began traveling from contest to contest. The professionals finally assembled into touring shows which now visit eastern American and European cities.

Among the many books about circuses are 'Big Top', by Fred Bradna; 'The Ringlings', by A. F. Harlow; and 'Under the Big Top', by Courtney Ryley Cooper (out of print).



THE STARS AND STRIPES IN AN ARMY PARADE

GOOD CITIZENSHIP
in Everyday Living

CITIZENSHIP. An army parade is coming down the street. Talking, laughing, and moving around, crowds of people line the sidewalks to catch the first glimpse of the soldiers. Suddenly there is a hush. Coming into view is the flag of the United States of America. Everyone stands a little straighter. Men remove their hats, and both men and women place their right hands over their hearts. The loud talking and arm waving stop as the Stars and Stripes pass in review.

The soldiers in the parade are acting as good citizens by serving in the armed forces of their country. The people watching the parade are also acting as good citizens when they honor the Stars and Stripes. Showing respect for the flag shows respect for the nation it represents—the United States of America.

It is election day. For several weeks people have been wearing campaign buttons which show the names of their favorite candidates. Everyone has been listening to speeches on radio and television and reading about the campaign in the newspapers. On the morning of election day adults vote and perhaps drive some elderly people to the polls.

Being able to cast a free, secret ballot is one of the greatest privileges granted to citizens. Every good citizen takes pride in voting to show his choice. This helps make democracy work.

SECRET BALLOT RECORDS A VOTER'S CHOICE

PARENTS AND CHILDREN PLAN A VACATION

JUNIOR RED CROSS MEMBERS PACK A GIFT BOX

STUDENT COUNCIL HOLDING A MEETING

A family is planning its vacation. They are grouped around a table looking at maps, atlases, and the encyclopedia. They are all eager to help plan their vacation. Father and mother lead the discussion and each one takes part in the planning.

The members of this family are being good citizens in allowing each one to say what he thinks. Respecting the rights and opinions of others is the core of good citizenship.

The Junior Red Cross is beginning to collect toys, writing materials, soap, toothpaste, and other items for its gift boxes. Every boy and girl in school brings in as many of these things as he can. The articles are then packed in boxes and sent as gifts to poor children in a foreign country.

Giving help to those who need it is one mark of good citizenship. The good citizen is always a friendly, sympathetic person who shares with others.

The students in a grade school are discussing ways of keeping the playground clean and safe. Each boy and girl is learning his duty to the school and to other children. They decide to have a special committee of students for each week to take charge of the cleanup and safety campaign.

Students who help make safety plans for their community and then work to carry out these plans are practicing the finest type of citizenship.

These scenes show only five ways in which a person can be a good citizen. In actual day-to-day life there are hundreds of ways of being a good citizen. Such a person can always be recognized by what he does, what he thinks, and how he feels toward his fellow men, his community, and his nation.

What Is Citizenship?

All nations have citizens. In each nation there are laws and customs which give special rights to citizens and demand from them certain duties. For example, a citizen may become a government official, may have special property rights, and may have a voice in the government through his vote. At the same time, citizens must pay their share of taxes and may be required to serve in the armed forces of their country. The rights and duties together are called *citizenship*. Almost everyone regards citizenship in his country as a wonderful privilege. Citizens are proud of their nation and the part it has played in the history of the world.

Some nations give more privileges to their citizens than do others. Some nations demand more duties of their citizens than do others. In every free nation, such as the United States and Canada, the citizens themselves are the real rulers. Their governments can do only those things which the people authorize. Thus the government may be strong or weak, just or unjust, fair or unfair, depending upon the interest and desires of its citizens.

Pathways to Good Citizenship

EVERY thoughtful person will agree that there can be a big difference between citizenship and *good citizenship*. The famous American author Mark Twain once pointed out the importance of this difference in a free nation. He said, "What keeps a republic on its legs is good citizenship."

There is no single, easy road to good citizenship, but rather a whole series of pathways. Each individual must go his own way. In general, however, the first and most important ideas of good citizenship come from the home, the school, and the church.

Citizenship begins in the home. Here is the first and best place for every youngster to learn to share, to help others, and to do his part. From father,

mother, and older brother and sister, small children learn their first lessons in truthfulness, honesty, and sympathy. The love and training that a youngster receives in a good home help him throughout his life.

All studies show that child problems and problem children come most often from homes that lack love and care. Love of fellow man and respect for the rights of others are best learned in day-to-day family life. The family in which all members enjoy life together usually gets along well with others.

Every boy and girl in America must attend school. This provides the second source of good citizenship. It is in the school that one learns to take pride in the achievements and sacrifices of his countrymen. In school one also learns to understand the meaning of and appreciate the great documents of the United States—the Declaration of Independence; the Constitution; the Bill of Rights, or first ten amendments to the Constitution. (The growth of the "American way" is traced in the Reference-Outline for American Heritage.)

In addition to its classroom teaching, the school presents a wide range of participation activities such as student council, athletics, dramatics, music, and interest clubs. In such activities, pupils learn to share, to co-operate, and to respect one another. Many schools also give vocational guidance and training. With this help young people can find out and train for the types of jobs which best suit them. Thus they can later contribute to the economic life of the community and the nation.

A FAMILY VISITS THE NATION'S CAPITAL

Citizenship is learned in day-to-day family living. This family is visiting the National Archives Building where important government documents are kept in Washington, D.C.

The third foundation of good citizenship is the church. Every church helps develop character and basic goodness in its members. All creeds provide sound guides for desirable social behavior. A person who practices the principles taught in his church discovers that the teachings aid him in his daily life by setting a high standard for conduct.

The boys and girls who make good use of these three pathways—the home, the school, and the church—are taking important steps toward becoming good citizens. In most communities a fourth pathway is provided by the many organizations which sponsor citizenship training. By taking advantage of these opportunities young people gain valuable experience

TWO PATHWAYS TO GOOD CITIZENSHIP

A person who follows the principles taught in his church is well on the way toward becoming a good citizen.

School traffic patrols not only promote safety but they also help develop good citizenship.

for becoming the adult citizens of tomorrow At the end of this article is a list of some of these activities and programs

From these different pathways come not just one type of citizen but many millions of well meaning people of different views beliefs and opinions There are majorities and minorities in almost every aspect of life—in politics, in education in social life and in religion Every citizen is a member of a minority group in some instances and a majority group in others Throughout the history of the nation all such groups have made their share of sacrifices as well as their share of contributions for the common good This has always been one of the great strengths of the United States

The future of every free society depends entirely upon its citizens If the society is to grow and improve itself each citizen must know all his responsibilities and do all his duties These responsibilities and duties fall into three general classes—social economic, and political

Being a Good Citizen Socially

To MAINTAIN life all human beings must have food shelter and clothing In addition to these basic *needs* there are many human *wants* such as friendship and prestige Almost all wants are social in origin, action, or result—that is they need the help and co-operation of other people Good social citizenship depends upon ability to work and play in social groups The American poet Robert Frost summed up social relationships when he wrote

"Men work together,' I told him from the heart,
"Whether they work together or apart

Throughout the ages many people have tried to define good social behavior Some of their ideas have become part of today's "rules' for good conduct These are not rules in the usual sense but rather standards of behavior, acceptable customs or codes of ethics An example would be the Golden Rule, which many different peoples have stated in various ways but always to mean "Do unto others as you would have them do unto you" These rules agree with and support fundamental laws customs and religious beliefs The understanding of these rules is one mark of a well balanced personality

The good citizen socially is considerate of others of their needs wants and rights He recognizes that people have different national backgrounds religions and customs and he respects the differences He need not agree with all that other people believe but he respects their beliefs In a very real sense good citizenship requires a willingness to respect people of all races, creeds, and national origins

In social groups the good citizen sometimes acts as a leader and sometimes as a follower He may serve the group by defending his point of view at times by compromising at other times, and by sometimes accepting the opinion of others

The good citizen preserves and helps to develop basic social institutions This means that he supports his home his church his community, and his nation He may see weaknesses in local government in the school system or in some other institution If so, he does not withdraw from the institution but instead actively tries to improve it

Good citizens exhibit honorable behavior They are faithful to the customs and laws of society Their example strengthens all the social groups in which they live They stand up for what is right and take action against what is wrong

The good citizen is also a friendly person He knows how to get along well with people He is loyal to his friends and sympathetic toward all mankind He is pleasant to talk to and quick to help others when he can Friendship and personal associations are very important to everyone The citizen who does his part is always respected by his fellow men

These qualities and attitudes make a good citizen socially Such people are highly important in a democracy because they make society human and warm. This is a way of life that stands in sharp contrast to the heartless tyrannical societies found in some other parts of the world

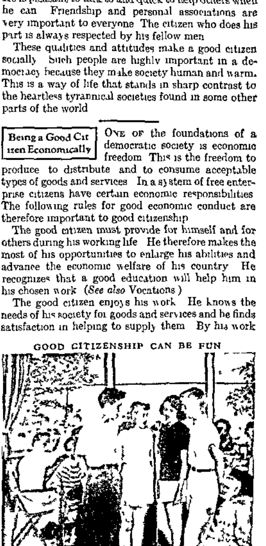
Being a Good Citizen Economically

ONE OF the foundations of a democratic society is economic freedom This is the freedom to produce to distribute and to consume acceptable types of goods and services In a system of free enterprise citizens have certain economic responsibilities The following rules for good economic conduct are therefore important to good citizenship

The good citizen must provide for himself and for others during his working life He therefore makes the most of his opportunities to enlarge his abilities and advance the economic welfare of his country He recognizes that a good education will help him in his chosen work (*See also* Vocations)

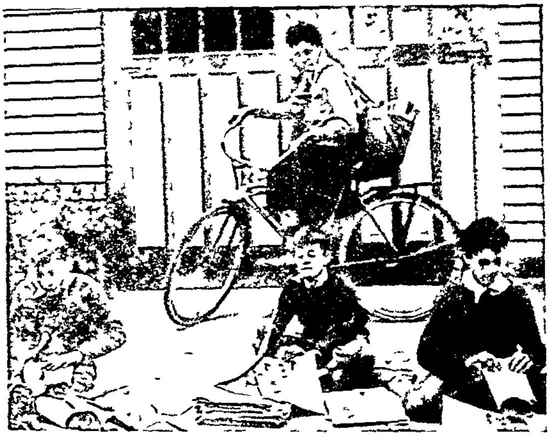
The good citizen enjoys his work He knows the needs of his society for goods and services and he finds satisfaction in helping to supply them By his work

GOOD CITIZENSHIP CAN BE FUN



The good social citizen enjoys the company of others This quartet is entertaining other teen agers at a summer camp.

CITIZENSHIP IN THE WORLD OF BUSINESS



Economic citizenship begins as soon as a person is old enough to handle his own money. Newsboys (left) earn money by delivering papers. By paying taxes (right), adults help meet the cost of services provided by the local, state, and national governments.

he makes a definite contribution to himself, his family, and society.

Being a good citizen also means making and carrying out economic plans for the wise use of his income. He learns how to budget his money and to provide for his future economic security. He pays his debts on time and does not waste money. (*See also* Thrift; Home Economics.)

Citizenship requires that each person help protect the rights of others to work and to enjoy their earnings. This may sometimes mean taking an active part in opposing illegal or questionable business and labor activities. It may at other times mean encouraging desirable business and labor practices. Thus to be a good citizen economically means producing efficiently, consuming wisely, and protecting the legal economic activities of other citizens. (*See* Labor.)

Being a Good Citizen Politically

THE government of a democratic society is built upon the political activities of its citizens. Only in a democracy are politics and civic life so very important. Making government serve its citizens is a job for all. This can be done by following a few rules for good political citizenship.

To take an active part in American political life it is necessary to understand the governmental problems of the times. The person who does not understand such problems may be misled by slogans and by personal prejudices. The good citizen reads newspapers and follows the news on radio and television. He also reads widely on the important long-range issues, such as world peace, public education, and conservation. When he learns all he can about current problems he decides what is wrong and what is right. He then makes his decisions known to the political leaders of his community, state, and nation. This helps to create an active, intelligent public opinion.

The good citizen takes an active part in politics, especially at the local level. He attends political meetings as often as possible and participates in the discussion of issues. It is at the local level that candidates for public office are proposed and delegates to political conventions are chosen. Only an active, well-informed citizenry can keep politics clean and useful.

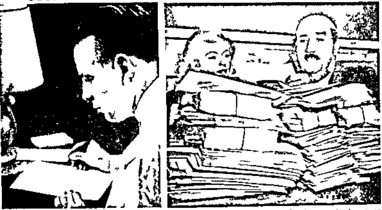
Every citizen should be a registered and thoughtful voter. He should cast a ballot in each local, state, and national election. Millions of eligible people do not vote. This "negative vote" may permit the election of candidates and the approval of decisions that are not in the best interest of the citizen or his government. No citizen can support good government and able public servants by failing to vote. A democracy expects its citizens to make their choice known by the ballot.

The good citizen is willing to serve his government in any capacity that he can. During the early days of the republic men such as Washington, Hamilton, Jefferson, and Madison took time from their private lives to work for the government. Since that time many of the finest men in the nation have served in political offices. The need for capable public servants is still very great today, and every good citizen should be willing to serve in public office when he can be useful to his fellow citizens.

The good citizen keeps up an active interest in politics between elections. Many people work hard to help win an election and then pay little attention to the official life of their elected leaders. Everyone has a duty to keep his congressman, governor, and other political officeholders informed of his wishes. A good public servant is responsive to opinions received in person and through letters, telegrams, and telephone calls.

Perhaps the most important guide to good citizenship is to be politically alert and aware of what is going on in the community, the nation, and the world. Over the entrance to the Nebraska State Capitol appears a sentence that expresses the fundamental political duty of the good citizen. It is: "The Salvation of the State is Watchfulness in the Citizen."

GOOD CITIZENS HELP MAKE GOOD GOVERNMENT



Good citizens write to their congressman to give their opinions about important issues (left) The congressman (right) then knows what the people he represents want him to do

relation to other nations He should study the workings of the United States Department of State, the North Atlantic Treaty Organization and the United Nations He should know the role of the armed services in peace and war

In addition every able-bodied citizen should prepare himself for duty in a crisis Thousands of young men and women enroll in the reserve units of the armed forces Others develop skills which may be used in vital industries or in civilian defense Then when danger threatens the Selective Service System determines who will serve in the armed forces and sometimes in what branch The authority to draft young men into the armed services lies in the Congress This power to provide for the common defense was granted by the people through the Constitution

In time of war there are many individual responsibilities for a citizen in a free society He must keep all military secrets with which he is entrusted He must conserve vital war materials donate blood if possible buy his share of war (or defense) bonds and co-operate with civilian defense organizations such as the Ground Observer Corps

War is a trying experience for any nation It requires the attention and activity of all its people The United States has remained strong and free because free men and women have always been willing to come to its defense

Sometimes the privilege of voting is confused with the rights of citizenship To be eligible to vote a person must be a citizen of a state and of the United States Each state defines exactly who can vote in that state by setting minimum requirements for age and residence In each state the voter must register and identify himself at the polls Thus while all voters must be citizens not all citizens may be qualified to vote at election time The requirements for voting in each state are given in the Fact Summary in each state article

The Citizen and National Defense

THE responsibility for the defense of the United States is shared by all its people The cornerstone of that defense is the individual citizen who must always be prepared to help his nation in any way he can

Alexander Hamilton one of America's first great statesmen once wrote Those who enjoy the fruits of democracy must be willing to bear arms in its defense This statement has special meaning during the middle of the 20th century when the United States has to provide constantly for national defense Since the beginning of World War II it has been necessary to maintain a large army navy and air force as well as a widespread civilian defense program Long after the end of World War II large numbers of American troops ships and planes had to be retained in Europe in Japan and in the Pacific to defend against possible attack From 1950 to 1953 more than a million and a half American citizens had to fight in Korea to hold back Communist aggression

Millions of other Americans at home contributed their abilities energies and money to the support of the national defense Their contributions were made in many different ways Every community offers opportunities to serve the nation Each citizen should find a way to do his part

The good citizen begins to help with national defense when he understands his country's problems in

The Rights of American Citizenship

EVERY American has reason to be grateful to the courageous group of men who adopted the Declaration of Independence July 4 1776 The second sentence of that Declaration established the cornerstone of *civil rights* now enjoyed by every citizen We hold these truths to be self evident that all men are created equal that they are endowed by their Creator with certain unalienable Rights that among these are Life Liberty and the pursuit of Happiness These rights were later guaranteed to every citizen by the United States Constitution and by each state constitution

Civil rights may be classified into three major groups personal rights the legal rights to justice and property rights It is of the utmost importance that every citizen stand up for his civil rights and respect the rights of others Without these rights there is no free democratic society

Personal Rights and Freedom

The most fundamental civil right is that of being free Freedom means more than just not being a slave

It means many things—the right to choose a job, to move about the country at will, to choose a wife or husband, and to pursue happiness in any peaceful way.

A second great personal right is religious liberty. The 1st amendment to the Constitution states that "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof." Thus each American is free to belong to any one (or none) of the 250 different religious groups in the United States.

A third important right is freedom of speech and of the press (including radio and television). Congress is forbidden to pass any laws which would prevent speaking, writing, or broadcasting freely on any subject desired. The only legal restriction on this right forbids lies about another person or the communication of illegal or indecent material.

READY TO DEFEND THEIR NATION

In time of danger every citizen must come to the defense of his country. These men are taking the oath required of all members of the armed forces.

Freedom of assembly and petition is a fourth personal freedom. This means that citizens have the right to hold meetings, to form political parties, conduct campaigns, and publicly petition the government for new laws or the repeal of existing laws.

The right to keep and bear arms is a fifth freedom granted to Americans as "necessary to the security of a free State." This right to own firearms, however, is subject to certain local safety laws such as prohibiting the carrying of concealed weapons without a license to do so. (*See also* Firearms.)

The Right to Justice

When a citizen is accused of a crime he is protected by a whole body of legal guarantees and safeguards. One of the most important is: no citizen can be convicted of treason unless two witnesses of the same treasonable act appear against him or he confesses in open court. Totalitarian governments often destroy minority groups by accusing them of treason merely because they disagree with the party in power.

Another technique of dictators is to imprison people for long periods without bringing them to trial. In the United States the citizen can be protected from this practice by obtaining a writ of habeas corpus. (*See also* Habeas Corpus.)

A third right to justice prohibits Congress or state legislatures from passing laws which declare a person guilty of a crime without a trial. Such laws are called *bills of attainder*.

A fourth right prohibits *ex post facto* ("after the fact") laws. This means that a person cannot be accused of a crime if the act was committed before such an offense was declared to be a crime.

Regulation of search and seizure is a fifth protection for the citizen. No police officer can enter a home to search it or to seize evidence unless he carries a legal search warrant granted by a judge.

A sixth protection is against excessive bail. The judge must set a reasonable bail for the accused to guarantee his appearance in court. This gives the accused a chance to prepare a defense while free on bail.

A seventh right to justice prohibits excessive fines and cruel or unusual punishment. This protects the citizen against the tortures used in some modern police states.

Another right that an accused person has in the United States is the guarantee of a fair trial. This right—perhaps the greatest protection of all—involves a number of safeguards. It means the right to a *grand jury* hearing (*see* Jury). It means that no accused person or his spouse may be forced to give testimony which might help to convict him (5th amendment to the Constitution). It means that in certain cases the accused may ask for a new trial or appeal his conviction to a higher court.

An accused person has the right to a trial by an impartial jury consisting of members of his own community, or, if this will not produce a fair trial, he may have it moved to another locality.

In America, a trial must be publicly announced. The accused has a right to confront his accusers. He has the right to summon defense witnesses by court *subpoenas* (orders to appear in court). Furthermore he has a right to obtain legal advice even if he cannot afford to pay for a lawyer to defend him. (*See also* Courts of Justice.)

Right to Ownership of Property

The third group of civil rights enjoyed by American citizens deals with the ownership of property. Every citizen has the right to own and use property. This property cannot be decreased in value by an act of the government "without due process of law"—that is, according to legal procedures and established customs.

Sometimes the government may condemn property to make way for streets, highways, parks, or public buildings. In these cases the owner must receive a fair market price for his property. If he desires he may

UNITED STATES CITIZENS BY CHOICE

The federal judge (at the right) is administering the oath of allegiance to the United States required of all naturalized citizens.

ask a court to set a fair valuation on the property. (*See also* United States Constitution.)

Legal Basis of Citizenship

EVERY nation provides ways and means by which a person becomes a citizen of that nation. In the United States citizenship is defined in the 14th amendment to the Constitution. Section 1 of this amendment begins: "All persons born or naturalized in the United States and subject to the jurisdiction thereof, are citizens of the United States and of the State wherein they reside."

Residents of the United States who are not citizens by birth or naturalization are called *aliens*. Aliens are entitled to the protection of the laws and the use of the courts. They usually have the right to own property, to engage in business, and to attend free public schools. Aliens may not vote or hold public office or be employed as government officials. In many states aliens cannot acquire licenses to engage in certain professions. The United States government protects its citizens while they are abroad but not its alien residents. In addition aliens may be deported to the country of their origin if they commit certain crimes or work against the welfare of the United States.

Citizenship by Birth

There are two basic theories for determining citizenship by birth. One theory is the law of blood relationship (*jus sanguinis*). Under this theory the citizenship of a child is determined solely by the citizenship of the male parent. For example, if the father is an Italian citizen, his children are citizens of Italy no matter where they are born. In ancient and medieval times this method of determining citizenship was common.

If the principle of blood relationship had been followed in the United States there would never have been any American citizens except Indians. From the Jamestown settlers of 1607 down to the present day all immigrants to the United States would have retained the citizenship of their native lands and this citizenship would have been handed on to their children in each generation. Recognizing this fact, the United States government adopted another basis for citizenship called "law of place" (*jus soli*). Under this principle citizenship is determined by the place of birth without regard to the citizenship of the parents. In modern times this method has been widely adopted by many countries.

The United States extends citizenship to everyone born in the United States except the children of parents not subject to the jurisdiction of the government, such as foreign diplomats. Children born to Americans living abroad are also American citizens if one parent is a citizen who has lived in the United States or its outlying possessions at least ten years, five of which were after the age of 16. In all cases the child must live in the United States or its possessions for a period of five years between the ages of 13 and 21. This is to provide for education and language development to fit the child for American citizenship.

Citizenship by Naturalization

Obtaining citizenship by naturalization is open to all aliens who qualify under the laws passed by Congress. (For the details of how individuals may become citizens, *see* Naturalization.)

Several times the United States has used a process of collective naturalization through the treaty-making power of the president and the Senate. Such was the case when the territories of Louisiana, Florida, Texas, Alaska, and Hawaii were annexed to the Union. Each time citizenship was conferred upon the whole body of inhabitants within the territory. Congress has also conferred citizenship upon those inhabitants of the Virgin Islands and Puerto Rico who wanted it. The others are called nationals. During World War II and again from 1950 to 1955 many aliens serving in the armed forces of the United States were granted citizenship without the regularly required waiting period.

Giving Up Citizenship

Until after the Civil War no citizen of the United States could give up his citizenship. Then in 1868 Congress recognized the right of *expatriation*, or giving up of citizenship. This permits an American citizen to renounce his citizenship by swearing allegiance to a foreign government. Expatriation is not permitted in wartime.

Naturalized American citizens lose citizenship if they return to their native land for as long as two years or if they live in any foreign country for five years. Exceptions are allowed only if the person makes special arrangements with the Department of State. (*See* Passport.) Citizenship may also be for-

feited if a person votes in a foreign election or serves in the armed forces of a foreign nation.

History of Citizenship

In ancient Athens citizenship was granted only to a favored few classes of people. It was the citizens who advanced art and learning and served as government officials. Most labor was done by slaves, freed slaves, and resident aliens. Later the Roman government broadened the base of citizenship and also granted limited citizenship to thousands of conquered peoples. At the height of the Roman Empire the proudest boast a man could make was "I am a Roman citizen" (*Civis Romanus sum*).

As modern nations developed, governments granted citizenship status to more and more of their people. In America, citizenship received its first official recognition July 4, 1776, when the Continental Congress voted that "all persons abiding in any of the United Colonies and deriving protection from laws of the same owe allegiance to said laws and are members of such colonies." Later the Articles of Confederation (1781–89) provided that the "free inhabitants" of each state "shall be entitled to all the privileges and immunities of the free citizens in the several states."

The United States Constitution accepted the fact of citizenship but did not define the term. In the Dred Scott Decision in 1857 the United States Supreme Court ruled: "Every person, and every class and description of persons who were at the time of the adoption of the Constitution recognized as citizens in the several states, became also citizens of the new political body." This court decision excluded Negro slaves from citizenship until the passage of the Civil Rights Act of 1866. The 14th amendment, adopted two years later, established the citizenship of Negroes beyond repeal by a future Congress. Women received full political citizenship through the 19th amendment, ratified in 1920. Indians born within the United States have enjoyed full citizenship since 1924. All legislation dealing with natural-born citizens was codified by Congress in 1940. Immigration and naturalization laws were similarly acted upon in 1952.

Training Good Citizens

The following is a list of some of the activities and programs sponsored by various organizations to promote good citizenship.

Youth and Government. Sponsored by the Y.M.C.A. Provides guidance and training for political and moral leadership in public affairs.

Boy's State and Boy's Nation. Sponsored by the American Legion. Boy's State is an annual convention held in each state to study governmental problems. Boy's Nation is an annual meeting of two boys from each state to study the operations of the federal government. It is held in Washington, D. C.

Girl's State and Girl's Nation. Sponsored by the American Legion Auxiliary. Provides the same opportunities for political science training as that offered by Boy's State and Boy's Nation (*see* above).

Boys and Girls County Government. Sponsored by the American Legion. High schools elect one student to each county office. One day each year the elected students work with regular county officials at the county seat.

Other activities providing citizenship training for American youth are sponsored by the American Junior Red Cross, Boy Scouts of America, Camp Fire Girls, Future Homemakers of America, Future Farmers of America, Girl Scouts of America, 4-H Club's Extension Service, and the National Jewish Welfare Board. (*See* Juvenile Organizations and individual organizations in the FACT-INDEX.)

There are also many local and national programs in citizenship work aimed at giving general improvement to citizenship education in schools as well as in adult life. One such program is the Citizenship Education Project developed at Teachers College, Columbia University. It emphasizes the importance of the basic ideals that have guided the growth of the United States. Among other notable programs in citizenship education are those developed in the public schools of Detroit and Nebraska.

One of the most important of the national programs is the National Conference on Citizenship, sponsored by the National Education Association and the United States Department of Justice. Its aim is to aid various organizations concerned with the development of future citizens.

LEARNING THE MACHINERY OF GOVERNMENT

In this "Hi-Y" citizenship program the candidate for "governor" is giving a campaign speech to the members of the "legislature" and other qualified "voters."

THE FOUR FREEDOMS

FREEDOM OF SPEECH

FREEDOM OF WORSHIP

FREEDOM FROM WANT

FREEDOM FROM FEAR

Four priceless rewards of good citizenship in a free country were defined by President Franklin D Roosevelt in 1941 as essential human freedoms These are illustrated in the paintings by Norman Rockwell

REFERENCE-OUTLINE FOR STUDY OF CITIZENSHIP

BASIC CONCEPTS OF DEMOCRACY AND CITIZENSHIP

I The heritage of Western civ lization Greek reason sets men free W 209-10 influence of Christianity W 210-11 C-301 2 R 88 Magna Carta M-41 English Bill of Rights B-145 French Declaration of the Rights of Man F 293 American Declaration of Independence D-32 United States Constitution U-341 Human Rights and Freedoms (United Nations) U 242 243 See also the Reference-Outline for Individual Freedom

II The Amer can background see the Reference-Outlines for American Heritage and United States History

III The mean ng of citizenship C-319

CITIZENSHIP IN EVERYDAY LIVING

I Pathways to good cit zensh p C-319-319b
 A Family life F 16-20 on the farm F 21-32
 B Mean ng and purpose of education E-238-40

C. Influence of religion C-304, J-354
D. Marriage customs and problems M-100-101*b*

II. Being a good citizen socially, economically, and politically C-319*b*-*d*. See also the Reference-Outlines for Sociology, Economics, and Political Science
A. Importance of choosing a vocation V-499-515. See also the Reference-Outlines for Vocations and Industry, American
B. Obligation to exercise voting privilege E-288-9, B-36-7, S-442-3

III. How good citizenship is encouraged
A. For young people J-368*a*-*b*: Y.M.C.A. Y-342; Y.W.C.A. Y-343; Boy Scouts B-273; Girl Scouts G-113; Camp Fire Girls C-54; 4-H Clubs F-252; Future Farmers of America F-326*a*; Junior Red Cross R-87*a*
B. For the general welfare F-248-51, P-368-9: Red Cross R-87*a*; Salvation Army S-33; social settlements S-219; aid to blind and deaf B-206-7, D-25; Parent-Teacher Associations P-80
C. For community protection: fire and police departments F-85, P-352; health service H-308, H-300 (hospitals H-429); public housing H-432*e*
D. Patriotic societies, service organizations, and lodges P-98: American Legion A-223. See also names of organizations in Fact-Index

IV. The ideals good citizens live by
A. Worth of persons—individual differences, personality, and character development I-113-14, P-159*a*-160: American Negroes N-107. See also the Reference-Outline for Races of Mankind
B. Individual freedom I-115-20
C. Government by laws G-144, U-341, U-356
D. Sense of justice C-499, J-365, J-368
E. Capacity for self-government D-63-7
F. Civic participation: political parties P-357; elections E-288; state and municipal governments S-384*b*, M-450, town meetings T-159, picture U-263 (by television, pictures C-424*f*)
G. Flags, songs, and flowers symbolize political sovereignty F-119-38, N-40-43, S-384. See also Fact Summary in each state article

V. Good citizens are alert and informed: see the Reference-Outline for History (Current Events)

VI. The citizen and national defense C-319*d*: Army A-378: Navy N-80; Marine Corps M-96; Air Force A-79; Coast Guard C-371; National Guard and organized reserves A-383; blood donations B-207-8

VII. Rights of American citizenship C-319*d*-*f*

VIII. Legal basis of citizenship: by birth C-319*f*; by naturalization C-319*f*, N-43; by giving up citizenship (expatriation) C-319*f*-20

HISTORY OF CITIZENSHIP IN THE UNITED STATES

I. General C-320. See also the Reference-Outlines for American Heritage and United States History
A. American Colonies A-192-217
B. Pioneer life P-261-71: Far West F-37-43
C. Civil War and Reconstruction Period C-330-7, R-85-7: 14th Amendment U-354-5
D. Industrial America and increase in immigration U-381-2: where the people came from and how the population has grown, charts U-311, I-47; quota laws after World War I I-47-8

II. The American people and their achievements U-310-36, outline U-336-9

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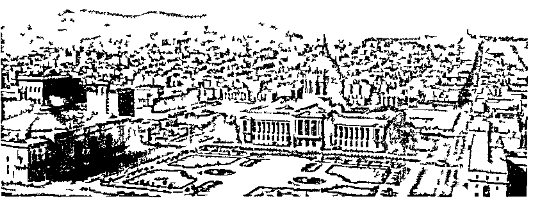
CITRON. The true citron (*Citrus medica*) used in fruitcakes and Christmas puddings grows on a small evergreen tree about ten feet high, usually in the same regions that produce lemons and oranges. Citron is really one of the "citrus fruits," which include the lemon, orange, and grapefruit. The fruit looks very much like a great rough lemon, five or six inches long. The center has a thick whitish flesh, while the skin is relatively thin and very fragrant. The Chinese sometimes use it as a house plant because of this fragrance. The dried rind when candied is the part used by the housewife. In the United States the citron is grown in both Florida and California.

Besides the true citron there is a small, round, solid, and almost flavorless watermelon that goes by the name of "citron." It grows in temperate regions and is used for making preserves.

GREAT CITIES—*Their* HISTORIES *and Their* PROBLEMS



It is a far cry from the ancient isolated city states of Greece from the medieval cities with their unpaved unlighted streets and open drains from the simple village of American colonial days even from the slums of unplanned modern cities to examples of modern city planning such as this one of San Francisco's Civic Center. More and more cities in all parts of the world are being replanned and rebuilt so that they will be more beautiful and more adapted to the needs of contemporary life.

CITY. When we speak of a city we usually mean an organized community with a considerable number of people occupying a limited area with resulting congestion and crowding. The term city however is used in more than one sense. In England it is an honorary title given through traditional usage or by royal charter to communities of some pre-eminence such as Episcopal sees and great industrial centers. Other communities no matter how large are called towns. In the United States the word city frequently refers to the form of government and not to the number of people. Requirements for city charters—that is the plan of government granted by the state legislatures—differ in various states. Often a population of 10 000 is required before a town may become a city.

At the start of the 19th century only a small percentage of the American people lived in cities. Today more than half of the population lives in cities. This rapid movement of population from the country to the city was caused by the Industrial Revolution a result of the discovery of steam power and its application to manufacturing transportation and agriculture. With laborsaving machinery one man could do as much work on the farm as 15 men with hand tools (*See also* Agriculture.)

Growth of Factories Builds Cities

What became of the 14 men whose work was no longer needed? Obviously some of them helped to manufacture the machinery that had displaced them from the farm. When furniture clothing and other necessities were made by hand people could manufacture them in small towns and in the country but after the discovery of steam power and the invention of machinery it was much more economical to build a large factory where one steam plant could furnish power for many machines. Those who worked in the factory of course had to live near it and when the factories got so large that they employed 25 000 people it meant that 25 000 people and their families had to live often in crowded areas within a short distance of the factory. Thus the growth of great modern cities began.

Three factors determined the selection of factory sites and thus indirectly the location of cities: nearness to fuel that the expense of hauling it to the factory might be saved; nearness to the source of the raw material for manufacturing; and cheap and adequate transportation facilities. Hence most of the great American cities grew up on ocean harbors on the Great Lakes on large rivers and at railroad centers. It was economic forces and not the problem of securing proper living conditions for the inhabitants that largely determined the sites for cities.

As cities became large and congested people were faced with a vast array of new and difficult problems. So long as they lived in rural communities the problems of health fire and police protection recreation and transportation were relatively simple. But the large city brought a whole new set of problems. Noisy factories emitted clouds of smoke and gas. A single case of contagious disease might endanger the lives of thousands. Bad water was a menace to the whole community. A single building on fire might bring down thousands more. Criminals could rob and steal with less fear of detection. These serious problems required the best imagination the most scientific skill and the most profound wisdom. Often the very persons who were victims of these conditions were indifferent to their existence.

Problems Bring Changes in Governments

The old type of government that existed in American cities was ill-adapted to cope with the growing needs and in many cases graft and corruption among public officials and politicians were making matters worse. Gradually however people began to awaken to the tragedies of city life and to see how they could work to make the city both a safe and a beautiful place in which to live. Students of municipal problems and safety engineers began to formulate construc

tive plans. These new ideas led to changes in the charters of city governments in many American cities. Old and cumbersome forms of government were modified: new plans, such as the commissioner and business manager form of organization, were adopted; and a strong "home rule" movement began to take form, especially among the larger and more progressive cities. (*See* Municipal Government.)

Safeguarding Public Health

Methods of safeguarding public health were instituted: caring for contagious diseases, establishing hospitals, providing pure water supplies, disposing of sewage in a sanitary manner, and abating smoke and noise nuisances. Housing conditions were studied with a view to avoiding crowding and obtaining light, wholesome air, and comfort. Parks and public playgrounds were established to provide opportunities for healthful outdoor life for children. (*See* Building Construction; Games; Health Department; Hospitals; Housing; Parks and Playgrounds; Play; Shelter; Smoke; Water Supply.)

HAVE YOUR FARE READY

This is an entrance to New York City's subway. Dropping a coin in the box releases a turnstile to let the passenger through. Subway and elevated trains travel 20 to 25 miles an hour.

The problem of transportation within cities and their environs, which depends in part on the physical conditions of a city site and the number of inhabitants, has received years of careful study. In the larger cities all practical ways of getting residents quickly from one point to another are used. In New York City, for example, the suburban railroad, and the subway, elevated, and motor-bus systems carry the largest number of passengers, while the ferries carry millions each year between Manhattan Island and the New Jersey and Long Island shores. In Chicago, where distances are great, the backbone of transportation is a vast street railway system, augmented by elevateds, motor buses, and subways. (*See* Buses; Street Railways; Tunnels and Subways.)

Traffic Lights Keep Automobiles Moving

In all modern cities wide streets and boulevards carry millions of rapidly moving motor cars. As a result much study has been devoted in recent years to the best ways of controlling traffic. In addition to traffic officers, electrically operated stop-and-go signs aid in controlling traffic with as little delay as possible. In one widely used system, called "principal progressive," traffic proceeds for a certain time along a principal street and then is halted to permit entry of motor cars from side streets and passage of pedestrians. Another system, the "co-ordinated flexible progressive" method, allows traffic to move without interruption in four directions at a given number of miles per hour throughout the entire system.

Many kinds of pavement are used on the streets of the modern city, for different conditions as well as costs are best met by a variety of material. Safety and durability may be the deciding factors, as in a manufacturing district; or they may be safety and freedom from noise and dust, as in a residential section. Among common types of pavement are macadam, asphalt, brick, stone blocks, wood blocks, and concrete. (*See* Roads and Streets.) City streets are generally lighted by electricity or gas. (*See* Electric Light and Power; Gas, Manufactured; Lamps; Lighting.)

The modern city usually disposes of its sewage through an extensive system of great underground pipes (*see* Sewerage). In addition, it collects and disposes of refuse, namely, garbage, or food wastes; rubbish, or material of no further use; and ashes from houses and industries. These are usually collected separately, but occasionally they are mixed. Sometimes a city finds that it is profitable to use some of the refuse for filling in low places, for making new land on lake fronts, or for other purposes; but few cities now salvage waste products, because of the heavy costs involved in handling and sorting. They are usually disposed of completely by burning them in great incinerators.

City Planning Movements

One of the most fruitful means for the improvement of the modern city has been the city planning movement. Most cities have grown up as chance directed, although a few have benefited by early planning, notably Washington, D.C., Buffalo, Detroit, and Canberra, the capital of Australia.

Although the history of city planning certainly goes back to the cities of the ancient world, the movement did not become an important factor in modern centers of population until the middle of the 19th century. Then economic conditions brought about a rapid growth in both European and American cities. Plans were proposed for the future development of Paris in 1853, and a few years later there was much activity in city planning throughout Germany, Italy, and Sweden. In the United States, the movement is principally the outgrowth of the genius of Daniel H. Burnham, who designed the remarkably beautiful and noteworthy group of buildings for the World's Columbian Exposition held at Chicago in 1893.

How Zoning Plan Aids Cities

An important division of the city planning movement is city zoning. Experts mark out areas which are to be used solely for certain designated purposes, such as business, residence, schools, police and fire

MAKING ROOM TO LIVE IN A CROWDED CITY

This picture by Fairchild Aerial Survey shows Parkchester a huge development in the Bronx New York City It houses 35 000 people on 130 acres Skillful planning has provided good light and air for all and generous ground space for recreation

department stations wholesale and warehouse buildings industrial plants for light and heavy manufacturing and produce markets Zoning also affects the style of architecture for example in New York the startlingly beautiful tower and setback types of skyscrapers were designed to meet the regulations of the zoning resolution (*see* Architecture) Since buildings are planned and grouped in relation to their sizes and uses provision may be made for adequate light and fresh air and a display of the beauties of building design Furthermore owners of property know for what purposes it may be used and they can thus plan wisely for its development Zoning is also an important feature in the safety program of a community

Another aspect of city planning is the grouping of public buildings in a civic center Ordinarily it includes the city hall courthouse public library art museum churches high schools and perhaps university or college buildings In large cities principal public buildings may form one group and other units may be designated for education art and community centers Noteworthy among American municipalities with civic center units built or planned are Springfield (Mass), Cleveland Camden Toledo Denver San Francisco and Pasadena

City planning guides not only building activity but also transportation This aspect includes the designing and placing of wharves and stations so that the movement of goods and people may be accomplished as efficiently as possible It also has to do with the location width kind and design of streets with the planning of public drives and boulevard systems and with the selection of sites for playgrounds and parks Special legal measures have been formulated whereby under certain conditions a community may condemn land needed for its plans for health and beautification with compensation to the owners

Some cities own and operate certain public utilities such as gas water light and power telephone and transportation This is called municipal ownership and whether or not it succeeds depends upon conditions in each locality the efficiency and intelligence of the local government and other factors As to the relative merits of municipal and private ownership of a community's utilities there is conflict of opinion among experts on the subject and it is doubtless too early to pass final judgment on the question (*See* Public Utilities)

AN ATTRACTIVE ARRANGEMENT FOR A SUBURB

If the cost of land is not great houses can be given generous space, as we see in this air view of a development in Pontiac Mich Curving avenues with interrupted cross streets keep fast motor traffic out of the community This provides quiet and safety

The city has become the home of art and culture, entertainment, and education. Such advantages have stimulated people to noble endeavor. Many cities have been transformed into communities of great beauty, with opportunities for self-improvement and civic advancement. Thoughtful people try to express through community activities their hopes and aspirations for the more abundant life. (The population movements to American cities and suburbs are discussed in the article Population.)

Ancient Cities Were Really States

For the beginning of the story of the city we must go far back in ancient times. We find that as early civilizations developed, the deeply rooted human feeling for companionship, protection, and the advancement of other common interests, such as trade, led to the building first of villages and small towns and then of cities. So it was in Babylonia and Egypt. The city of those days was not unlike the city of today in its chief features: streets, houses, business structures, and public buildings. The modern city, of course, does not have the strong surrounding wall for defense—an outstanding part of the early community.

In ancient Greece, the city was an independent unit, for ancient Greece never became a nation. Sometimes one city would extend its power over several other Greek cities and rule them as its subjects, as did Athens and Sparta; and sometimes cities would form loose federations for defense. (*See* Athens; Greece; Sparta.) In a similar way, the city-state Rome gradually conquered other city-states of Italy and then built up a vast empire, stretching from the British Isles on the west to Mesopotamia on the south. (*See* Roman History.)

After the downfall of the Roman Empire, the cities of Europe, which had been encouraged by the Romans, declined with the Germanic invasions. Then in the 11th century, as manufacturing and trade increased, they again became important. Many new towns and cities arose in this period. Some grew up about the remains of Roman communities. Others started with a group of merchants who gained permission to establish a community from some lord. Still others grew up about monasteries or the sites of great fairs. These communities rapidly became centers of commercial, industrial, and social life. At first, they were generally ruled and exploited by the nobility.

Battles Between Cities Ended Feudalism

The struggles between the cities, or towns, as they were then called, and their lords formed one of the important chapters in medieval history and helped to break up the feudal system. Community of interest developed in town life and fostered a spirit of independence which asserted itself in stubborn and continuous efforts of the townsmen to win greater measures of freedom. (*See* Feudalism; Middle Ages)

Privileges were nearly always gained at the cost of long and bitter struggles. The upper classes of medieval society resented the rise of the townsmen, who usually had been members of the serf, or peasant, class. At first the townsmen were glad to get a few favors from the officials who governed them. Then they won greater freedom—for example, when societies of craftsmen, or guilds, by united action secured special privileges; or when the lord, who sought funds for some vast enterprise, such as a crusade, became indebted to them for help (*see* Guilds). Sometimes the lord would join the townsmen to oppose his ruler; and on the other hand, a king would grant favors to the townsmen in order to thwart some ambitious noble

Between the 11th and 13th centuries, most of the important towns of Europe won charters granting them self-government. Some of them gained complete independence. Certain city-states, such as Venice, Genoa, and Florence, are notable for being centers not only of culture and learning but also of powerful commercial interests established in extensive territories. Likewise, the Hanseatic League of northern Germany became so powerful that it even declared war to protect its interests (*see* Hanseatic League) With the rise of powerful centralized governments, cities lost their former independence and became parts of the nations.

How MAN *Won* CIVILIZED *Ways of* LIVING

CIVILIZATION. Today in most countries people depend a great deal upon each other for meeting their many needs. We get food from farmers, ranchers, fruitgrowers, and others. Town and city workers produce manufactured goods and provide many services. Doctors, teachers, and other professional people do their part; and actors, artists, and writers help by making life more pleasurable and richer.

We call this interdependent way of living *civilization.* The word comes from the Latin *civis,* meaning "citizen." Therefore, it means that a civilized person is a member of an organized community.

Today most peoples of European descent and many others do much of their work with power-driven machinery. Hence this use of power might seem to be an essential feature of civilized life. Two hundred years ago, however, nobody had such machinery. Men did their work with their own strength and with help from work animals, water wheels, and perhaps the wind. Yet they too divided the work between farmers, craftsmen, merchants, and others. They had churches, schools, and governments. They lived by depending on each other and thus they were civilized.

Some of these ways of civilized living can be traced back to about 3000 B.C. Before this, men had taken several thousand years to develop the foundations for civilized living, such as learning to grow food and to make good homes and tools. The greatest achievements in the advance from the earliest ways of living are shown in pictures on later pages.

It might seem that in order to live better men would have made these advances quite generally

around the world Scientists are sure however that this did not happen The foundations of civilization were developed in relatively few locations in response to special conditions Civilization itself arose in even fewer localities in response to still more special conditions Elsewhere men continued to live by hunting and gathering wild plant food as mankind had done *since the beginning of time* *Apparently this lack of* change was the result of primitive belief that every thing in nature was controlled by good and evil spirits Thus the secret of getting along lay in winning favor from the spirits with magic ceremonies and sacrifices (*see* Magic) Such beliefs would largely prevent attempts to develop any improvements in a way of life

The advances from primitive hunting to civilization seem to have been made largely by men of the Mediterranean region who first lived in northern Africa A separate article on Man tells how a change of climate at the end of the Ice Age turned what had been a pleasant grassland into the present Sahara By 10 000 B C increasing dryness was driving these people to seek new homes wherever they could find a reliable water supply

Some entered Europe through Spain and Italy There they managed to live much as they always had so they achieved no progress Others moved eastward and there they encountered the special conditions which forced them to develop new ways of living

Forerunners of Civilization

These conditions existed along a belt of land called the Fertile Crescent which began in Egypt where the Nile River brought water from mountains far to the south It extended along the Mediterranean coast through mountainous Palestine and Syria and then turned east along the southern slopes of the mountains of Asia Minor These mountains caught moisture enough from the winds (especially in winter) *to maintain rivers through otherwise dry land* *By* far the greatest of these rivers were the Tigris and the Euphrates which flowed southeastward from the Asia Minor mountains across the newly made Arabian Desert to the Persian Gulf (*See* Mesopotamia)

Throughout this Crescent men had to stay near the rivers for water Therefore they had to learn how to live in fixed localities Relics from many sites along the Crescent show that by 5000 B C men had learned how to build good homes and get their food by growing crops and keeping domesticated animals They learned too how to make baskets and pottery and how to spin thread and weave cloth

They also learned to make improved stone tools by polishing the stone to get sharp edges and smooth sides Hence this level of culture has often been called *neolithic* to distinguish it from the cruder hunting life during which man used tools made by chipping stone (*see* Stone Age) Other terms are *barbarism* for the neolithic level and *savagery* for the hunting life

All this progress enabled people to live in village settlements and to meet simple needs for food, shelter, and clothing This, however was not enough to bring about the development of interdependence to a level that could be called civilization For this agriculture and other food production had to be developed to a level which would enable a portion of the population to produce food *for all* *Then those who were not* needed to help produce food could give their time to making better tools and other articles trading with other people acting as planners and leaders and in time keeping written records which preserved and enlarged knowledge

Irrigation—the Key to Civilization

Only special conditions could give rise to such a development Dry lands would not be productive enough to yield a large surplus of food Well watered land would be covered with thick tough grass and brush or would have dense forests In such regions,

FIRST STEPS TOWARD BETTER LIVING

When man learned to make fire he made his first major advance toward civilized living. Fire was a great help to him in cool climates and it frightened away dangerous animals It also enabled him to have the advantage of cooked food.

Another great advance was learning how to chip flint and other stones into knives borers spear points and other implements *With stone-tipped weapons men could kill large animals* and stone tools enabled women to prepare animal skins for garments.

In some localities men learned how to bake clay into pottery Pots could be used for boiling food and storing it for use in *times of scarcity* *This is one of the great advances which took* men from savagery to the level of barbarism

THREE CORNERSTONES OF CIVILIZATION

When men learned to produce food by growing crops and keeping domesticated animals, farmers working under favorable circumstances could produce a surplus to support other workers. These workers could in turn make things to improve living.

Even the best stone tools had only limited value for cultivating soil or cutting and shaping wood. When men learned to smelt metals from ore, as these Africans are doing, they could have far better tools and do much more to improve living.

This North American Indian is making a record by painting symbols on a hide. Wherever men advanced beyond this level of writing to the ability to preserve thoughts and knowledge, they won the last victory needed to become civilized.

men who had nothing better than stone tools could only clear small patches for support of their villages. They could hardly advance to making metal tools, for this would require a surplus of food to support workers skilled in such manufacture.

A surplus could be produced, however, along the margins of great rivers such as the Nile in Africa, the Tigris and the Euphrates in southwest Asia, and the Indus in the northwest part of the Indian peninsula. During most of the year, the dry climate of these regions would prevent dense growth on the land. Each river would flood when snow melted or seasonal rain fell on the mountainous headwaters. After each flood the land would be soft enough to be worked with simple tools; and after seed was planted water could be supplied by irrigation. Under such circumstances development of agriculture and crafts could proceed together, until interdependence had been built up to a civilized level.

The First Civilizations

Between 4000 and 3000 B.C., men along each of these rivers gradually advanced toward civilization. Each culture had characteristics suited to its region; but all the cultures had some characteristics in common because of their dependence upon irrigation.

To be successful, a civilization based upon irrigation must have organization and government. All early civilizations seem to have progressed from an earlier tribal faith in magic to a state religion (*see* Magic). Craftsmen and (as trade arose) merchants were gathered into cities. The controlling power for each city and the surrounding irrigated area was the temple and its priesthood. If a king or ruler was named, he might serve as high priest or he might be considered a god. (Such an organization is called a *theocratic* state.)

In order to keep records of payments, expenditures, and materials and supplies in storage, each culture developed a system of writing and some form of arithmetic (*see* Writing). They also devised calendars to keep track of the seasons (*see* Calendar).

At first, writing consisted largely of symbols needed for record keeping; but gradually men developed ability to make records of knowledge, thoughts, and literature. Whenever this advance was made in a country or region, it is considered as the birth of history for that region. (*See also* History.) In all the civilizations mentioned, this advance came within a century or two of 3000 B.C.

Civilization in China and America

The end of the Ice Age gave rise to civilized living in China, particularly along the Hwang Ho in the north (*see* China). This civilization had some contact with those farther west; but the enormous distance between them prevented any considerable exchange of cultural ideas until modern times.

Early in the Christian Era, the Mayan Indians of Central America developed a civilized culture. They had to clear away forests to produce food; but the warm climate produced a crop in only a few months of the year. In the remaining months, the farmers could do other work (*see* Mayas). At a much later time, the Inca Indians developed a civilized culture in the high mountains of Peru. This culture used irrigation, like the early ones in Egypt and Asia (*see* Incas).

Civilization in Egypt and Mesopotamia

Of all the early civilizations, the ones which contributed most to Europe were those of Egypt and Mesopotamia. By the dawn of history, about 3000 B.C., all the Egyptians were united under the rule of one king, his nobles, and a strong priesthood. Within a few centuries they brought irrigation to a state of perfection. Above all, they were great builders. Many of their pyramids and temples still stand, thousands of years after they were built. Their portrait statues are among the greatest ever produced. (*See also* Egypt, Ancient; Pyramids.)

In the Tigris-Euphrates Valley (Mesopotamia), as in Egypt the earliest civilization developed *near the* mouths of the rivers (*see* Mesopotamia) The final development from neolithic ways was made by a people called Sumerians They are believed to have invented wheeled transport and the potter's wheel and to have led in developing metalworking From them these arts spread in time over much of Asia and Europe It seems probable also that they led in developing massive architecture

After several centuries of rule the Sumerians were conquered by Semitic neighbors but the conquerors continued to practice Sumerian ways The later history of the Semites may be divided into three periods first, the Babylonian, Assyrian, and Chaldean (3000 B C-500 B C), second that which began with the adventures of the seagoing Phoenicians and ended with the destruction of Carthage by Rome just before the Christian Era, and third, the story of the Jews in Palestine.

The peoples of Mesopotamia made many and varied contributions to the development of science trade and art These are discussed in the article on Babylonia and Assyria Egyptian and Mesopotamian cultures were blended by a seafaring people called the Minoans, who had their principal cities on the island of Crete They spread civilized culture throughout the islands and coasts of the Aegean sea (*See also* Aegean Civilization)

Various neighbors of the Egyptians and Mesopotamians also made contributions to the growth of civilization Among them were the Phoenicians who were great sailors and colonizers Their trading colonies, founded after 1000 B C, extended along the Mediterranean as far as Spain They made great progress in writing and some scholars believe that the modern alphabets of Europe come from theirs (*See also* Phoenicians)

Another small people, the Hebrews, dwelt side by side with the Phoenicians Though they perished as a nation and were scattered all over the earth, they lived on as a great spiritual force through the religion which they gave to the world The Hebrews wrote one of the finest pieces of literature the Old Testament Jesus Christ, the founder of Christianity, was born a Jew. (*See* Jews)

Appearance of the Indo Europeans

By 1500 B C a fairly continuous block of civilized peoples extended from the Aegean Sea and northeastern Africa to beyond the Persian Gulf About this time a new group of peoples speaking related Indo-European, or Aryan, languages pushed from the northern grasslands into southern and western Europe, the Near East, and India Their early home was probably from south Russia to the Caspian Sea and different branches began to drift apart well before 2000 B C All spoke kindred languages—Celtic, Teutonic, Slavic, Latin, Greek Armenian, Persian, and Sanskrit being among the chief subfamilies It is now believed that these peoples were racially very much mixed They were grouped in clans and tribes, possessed horses cattle and sheep, and practiced a simple agriculture They had plows and wheeled wagons Some of them had learned the use of iron Their coming covered many centuries and was partly a filtering in of small groups and occasionally a mass movement with conquests of people in the settled regions Nearly everywhere their languages supplanted the earlier tongues

One of their groups founded the great Persian Empire which was to master all western Asia and which formed a model for the Macedonian Empire, and indirectly for the Roman The Persians also contributed through their religion, Zoroastrianism certain ideas which were adopted by the Jews and later taken over by Christianity (*See* Persian History)

The islands and coast around the Aegean Sea were the home of a flourishing civilization for at least a thousand years before the coming of the Greeks This culture, which has been called 'Minoan' after Minos the lawgiver and friend of Zeus seems to have reached its height in Crete (probably about 3000-1500 B C) (*See* Aegean Civilization)

Meantime other civilizations had been developing in China and India but they were so far off that they had little influence on the path of Western progress Today, however, when contact has been established across the oceans the art of China and Japan and the religious thought of India are getting increasing attention. (*See* China, India, Japan)

Greek Culture Inspires the World

The Greeks appear about 1500 B C as one of the wandering Indo-European peoples who were gradually moving southward and coming into contact with the Aegean civilization Their progress from Barbarism occupied many centuries, and with the growth of their culture a new age was born

By the 5th century B C, when Greek culture had reached its highest development men generally had learned to live permanently on the land and to subsist on its crops They had learned seafaring, trading, and soldiering, and had devised complex systems of government They had founded great religions—Brahmanism and Buddhism in India, Zoroastrianism in Persia, Confucianism in China, and Judaism, the religion of the Hebrews They had learned to use coins in trade and had made great inventions—writing, the use of bronze and iron seagoing ships, iron swords The horse had been tamed, and craftsmanship was highly developed It remained for the Greeks to produce a philosophy so deep and broad that it ruled man's thinking for a thousand years, to produce an art which is still man's greatest inspiration in the world of beauty, to develop a literature of unsurpassed magnificence, to create the studies of science and history by collecting and systematizing facts, and to develop the idea of democratic government Though the Greeks learned many of the fundamentals of life from the earlier civilizations, they added something unique to man's heritage The Greek freedom of mind is an ideal toward which man is still struggling (*See* Greece)

Greece and the other civilized regions of the eastern Mediterranean finally came under the political domination of the Romans, who had developed differences in character and culture. The Greeks were men of imagination and speculation; the Romans, builders and doers. One great contribution of Rome to later times was its development of law. Both specific rules and theories entered into the law of the Christian church and the Holy Roman Empire and have descendants in the law of today. Christianity spread through the empire and eventually to all Western Europe. (*See* Roman History.)

How the Arabs Preserved Culture

Through the so-called Dark Ages (375–800) which followed the decline of Rome, it was the Arabs who preserved the cultures of Greece and Rome. By their wide conquests Islam spread in a century and a quarter from the Indus to the Atlantic and Spain, and from the borders of China to upper Egypt. The intellectual life of the Arab world spread through the regions which the spirit of Greece had once dominated. The Arab conqueror contributed chiefly a religion, a language, and a fondness for poetry; from other civilizations they borrowed and preserved principles of government, law, science, philosophy, agriculture, commerce, and art. The Arab mind took up with fresh vigor the development of positive knowledge, which the Greeks had begun. India was another source of inspiration to them, particularly in mathematical science. Our "Arabic" numerals in their earliest form came from India (*see* Number System). Algebra was practically the creation of the Arabs; they developed spherical trigonometry, extended the knowledge of physics, and made great progress in astronomy and medicine. The manufacture of paper was learned by them from the Chinese and passed on by them to the Europeans. There grew up in the Moslem world, out of what were originally religious schools, a series of great universities which drew students from East and West. In Spain, Moorish universities became headquarters for a culture that was based on that of Greece, colored by other influences. (*See* Arabia and the Arabs; Education.)

Meanwhile Western Europe was going through the period of evolution which we call the Middle Ages (*see* Middle Ages). A new system of government and new ways of living developed (*see* Feudalism). Christianity gradually replaced old heathen beliefs, and contact with the East through the Crusades resulted in the revival of learning and the arts which we call the Renaissance (*see* Crusades; Renaissance).

About 500 years ago there were four epoch-making events which changed the whole course of civilization and led the way for the modern period. The invention of gunpowder revolutionized warfare. The invention of the compass opened the sea to exploration. The invention of the printing press enabled the multiplication of writings. The discovery that the earth goes around the sun, instead of the sun around the earth, changed men's ideas about the universe. (*See* Astronomy; Compass; Gunpowder; Printing.)

Even with these advances, life went on much as it had before. Nearly everything was still made laboriously by hand. Travel on foot, by horse, or sailing ships was as slow as it had been for thousands of years. It was not until about 100 years ago that the last stage of Civilization was begun by a series of inventions that multiplied the power of men over nature in ways that had hardly even been dreamed of.

The Beginning of the Modern Era

First came the steam engine, which not only revolutionized industry by furnishing power for newly invented machinery (*see* Industrial Revolution) but created a new era in travel and transportation by making possible the steamship and the railroad. Then came electricity, useful for power as well as for the telegraph, radio, and many other things. These inventions do not mean that there is any more genius in our time, for each new invention is based on something learned before. The bow and arrow and pottery rank relatively higher as inventions than automobiles or radio, because early man had nothing to build on.

In modern times we find that there is the same kind of differences in cultures and the same kind of influence of one upon the other that were noticeable in the early civilizations. We can distinguish the great divisions of Western, Chinese, and Indian civilizations and see that each differs from the others.

Contributions from Many Lands

The peculiarity of Western civilization is that it is adventurous, inventive, and individualistic. It has succeeded in going all over the world, but not in making everybody become like the West. Within the West are many different cultures which have had and will continue to have influence on one another. In Russia, Czechoslovakia, Poland, Yugoslavia, Bulgaria, and in parts of Germany and Hungary live the Slavs. Their languages and many of their customs are similar. Long before anyone thought of the Russian Revolution and Communism, all Slavs had a crude form of communism, that is, a system by which people owned and did things together. The Slavs are very musical, but a good deal of their music is in the minor key. Life has been hard for them, and they take starvation and injustice as something to be endured.

For the Latin peoples, such as the Italians, French, and Spanish, the struggle for existence has not been so difficult. There has been more gaiety and beauty in their lives, and some of their most valuable contributions to the world have been in the realm of the fine arts—painting, sculpture, literature, architecture, and music. Both France and Italy, however, have also produced some of the world's greatest scientists. To the Spanish and the Portuguese credit is due for their leadership in the great age of discovery.

The Teutons seem to be less imaginative but to work with a more steady effort than the Latins. The development of printing, a few great artists, and leadership in the Protestant revolt are among Germany's early contributions. It became a leader in many branches of science, and science as applied to industry was highly developed in the German technical schools.

The Germans attained great efficiency in government and in business methods They made notable contributions to literature, as well, and led in the development of modern music

The Scandinavians have never been great in numbers, but they early conquered the sea and enlarged the outlook of medieval Europe (*see* Northmen) Many of the officers and sailors on ships all over the world are Scandinavians They have also reached a high level of government and social culture at home (*see* Scandinavia)

The British are a mixture of several peoples They have done more to settle distant parts of the earth than anyone else and have carried their culture with them They showed great ability in governing more backward people England was the first nation to be formed in Western Europe Its Magna Carta which contains a forerunner of parliamentary government, is among the most famous of government documents Late in the 18th century scientific discoveries and inventions of labor saving machinery in England marked the beginning of the Industrial Revolution, which gave rise to a new stage In the arts, particularly in literature, the world has received a valuable heritage from the English

When the British came to America they found a rich and underpopulated country to which they had to apply different methods from those used in Europe Thus American culture got its start Many streams of immigration have come from cultures other than the English, but most of them have been molded into the Anglo-Saxon pattern The people of the United States belong to Western civilization but have worked out a culture of their own from a combination of European cultures

One of the most characteristic phases of modern civilizations is the development of national government with the emphasis on patriotism The nation works for the benefit of all, and in return patriotism is expected At the same time, the nations are trying to bring about international co-operation

CIVIL SERVICE During a Congressional debate in 1831 a New York senator, William L Marcy, used the phrase "to the victor belong the spoils" This saying accurately described the *spoils system* of appointing government workers Each time a new administration came to power thousands of public servants were discharged and their places filled by members of the victorious political party These wholesale changes were made with little or no regard to the employees' ability or job experience As a result the efficiency of government service was often very low

The situation reached a climax in 1881 when President James A Garfield was shot and killed by a disappointed office seeker An aroused public demanded an end to the evils of the spoils system Carl Schurz and others organized the National Civil Service Reform League New York passed the first state civil service law, requiring its employees to take a competitive examination Congress, which had nullified an earlier reform bill by withholding necessary funds, finally took corrective action by passing the Civil Service Act in 1883 This law, sponsored by Senator George Pendleton of Ohio, is the basis of the civil service system in effect today

The Pendleton Act created a *Civil Service Commission* of three members appointed by the president with the consent of the Senate Its chief job was to establish a merit system of appointment to certain public offices—that is employees would obtain government jobs on the basis of demonstrated fitness without regard to politics race or religion The first law provided competitive examinations for 13 000 government clerks Since that time the number of positions covered by civil service has steadily increased Today more than 90 per cent of all federal employees receive and hold their jobs under civil service (Excluded are all policy-making positions) About half the states and most of the larger cities have their own civil service systems Canada has a merit system of government employment founded in 1908

The heart of the civil service system is the *classified service*, which is organized into five major classes of jobs—professional subprofessional clerical, administrative and fiscal custodial, and clerical mechanical Each of these classes is subdivided into grades with established salary schedules and promotion opportunities Classified workers are protected from ordinary political influence and can be removed only for cause They are also provided with retirement allowances

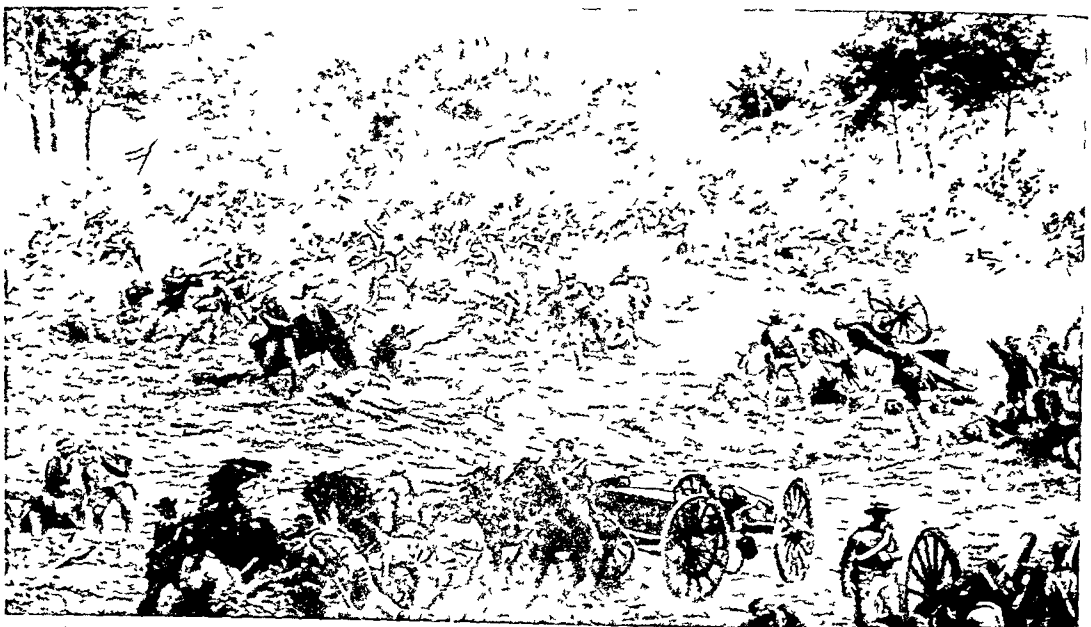
Unclassified workers do not have this civil service status They are temporary employees who are hired as needed Such workers do not take merit examinations and may be dismissed at any time

Civil service employees may join professional groups affiliated with labor unions but they cannot strike Their political activities are limited by the Hatch acts of 1939–40 (*see* Political Parties) Members of political groups advocating the overthrow of the government are barred from federal employment

Civil service employees work in Washington, D C, and in field services at home and abroad Examinations are held in more than 700 cities in every state and territory Information regarding examinations may be obtained at any first- or second-class post office or from the Civil Service Commission, Washington, D C

CIVIL WAR Of all the wars fought by men probably the cruelest are civil wars in which two or more factions within a nation fight for control of the government A civil war is more organized than a local rebellion or insurrection In such a war opposing forces have the status of separate states, each with its own territory and its own armies

One of the earliest civil wars took place in England It was a conflict between the Puritans and the Cavaliers, 1642–49 (*see* English History) Other major civil wars have been fought in the United States, 1861–65, Russia, 1918–20, Spain, 1936–39, and China, beginning in 1946 (*See also* Civil War, American; China, Russia, Spain)



The Climax of the Civil War Was the Union's Repulse of Gen George E Pickett's Charge at Gettysburg

The WAR *That* REUNITED *the* NATION

CIVIL WAR, AMERICAN. At 4 30 A M on April 12, 1861, Confederate artillery in Charleston, S C, opened fire on Fort Sumter, which was held by the United States Army. The bombardment set off a savage four-year war between two great geographic sections of the United States. One section was the North—23 Northern and Western states that supported the federal government. The other section was the South—11 Southern states that had seceded (withdrawn) from the Union and formed an independent government called the Confederate States of America. The struggle between these two combatants is the American Civil War, also known as the War Between the States or the War of the Rebellion.

The war aims of both sides were simple. At the beginning the North fought only to preserve the Union. The South fought to win recognition as an independent nation. After 1862 the long-troublesome slavery problem became an additional issue of vast importance. A Northern victory would mean ultimate freedom for slaves; a Southern victory would insure the protection of slavery in all Confederate states.

The Basic Issue of States' Rights

The Civil War came as a climax to a long series of quarrels between the North and South over the interpretation of the United States Constitution. In general, the North favored a loose interpretation that would grant the federal government expanded powers. The South objected to this centralization of authority and wanted to reserve all undefined powers to the individual states (*see* States' Rights).

This difference of opinion sprang primarily from economic considerations. The North, as well as the West, wanted internal improvements sponsored by the federal government—roads, railroads, and canals. The South, however, had little desire for these projects. Another source of conflict was the opening of public lands in the West. The distribution of such lands in small lots speeded the development of this section; but it was opposed in the South because it aided the free farmer rather than the slaveholding plantation owner. A similar quarrel developed over the tariff. A high tariff protected the Northern manufacturer. The South wanted a low tariff in order to trade its cotton and other products for cheap foreign goods.

One issue, however, overshadowed all others—the right of the federal government to prohibit slavery in the Western territories. Such legislation would severely limit the number of slave states in the Union. At the same time the number of free states would keep multiplying. Many Southerners feared that a government increasingly dominated by free states might eventually endanger existing slaveholdings. Thus the South strongly opposed all efforts to block the expansion of slavery. If the federal government did succeed in exercising this power many Southern political leaders threatened *secession* as a means of protecting states' rights.

The Slavery System in the South

The doctrine of states' rights might not have assumed such great importance had it not been related to the more basic issue of Negro slave labor. Slavery was introduced into Virginia with the first importation of Negroes in 1619 and gradually spread to all the colonies. It flourished most, however, in the

Southern colonies where slaves could be used profitably as field hands in the cultivation of tobacco rice and indigo When the American Revolution broke out three fourths of the Negroes lived south of the Mason and Dixon s Line

After the war slavery became more and more unpopular By 1804 seven of the northernmost states had abolished slavery and emancipation (the freeing of slaves) was common even in Virginia Maryland and Delaware

Just as slavery seemed to be dying out it was revived by an agricultural rebirth in the South A new demand for cotton and the introduction of improved machinery such as the cotton gin transformed the Southern states into the greatest cotton growing region in the world (*see* Cotton) Cotton production jumped from 178 000 bales in 1810 to 3 841 000 bales in 1860 To achieve this tremendous increase required a whole army of new workers chiefly Negro slaves Within 50 years the number of slaves rose from about 1 190 000 to almost 4 000 000 valued at about $2 000 000 000

Abolitionists and Their Work

At the same time that slavery became highly profitable in the South a wave of democratic reform swept the North and West There were new demands for political equality as well as for social and economic advances The goals were free public education rights for women better wages and working conditions for laborers and more humane treatment for criminals and the insane

This crusading ardor soon led to an all-out attack on the slavery system in the South It charged that such an institution nullified the greatest human right —that of being a free person Reformers now called for the complete abolition of slavery

The first Abolitionist to gain national attention was William Lloyd Garrison of Boston in 1831 (*see* Garrison) Within a few years Abolitionist newspapers orators and societies sprang up throughout the North Some of the Abolitionists even denounced the federal Constitution because it legalized and condoned slavery Such a radical was Wendell Phillips one of New England s ablest orators In 1836 he gave up his law practice because his conscience would not allow him to take the oath to support the Constitution

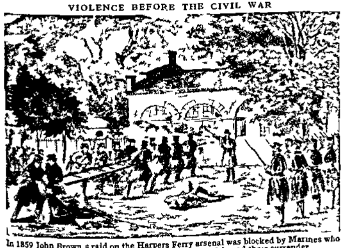
About the same time James G Birney of Ohio a former slaveholder in Kentucky began gathering all antislavery forces into one political unit the Liberty party Under this label he ran for president in 1840 and again in 1844 Other notable Abolitionists were John Greenleaf Whittier the Quaker poet Theodore Parker a Unitarian preacher from Boston called the terrible pastor of Abolition and James Russell Lowell who denounced slavery in prose and verse (*see* Lowell James Russell Whittier)

Despite their noisy campaign the Abolitionists remained a small minority They were generally condemned by their neighbors and were often the victims of ruthless persecution Some antislavery printing offices were mobbed and burned One Abolitionist editor Elijah Lovejoy of Alton Ill was murdered when a mob attacked his press

Many of the Abolitionists had no firsthand knowledge of slavery and their criticisms were often wide of the mark Southerners who might have doubted the wisdom of slavery now began to defend it with great earnestness They said it was not a necessary evil but a righteous and benevolent institution They compared it with the wage-slave system of the North and claimed that the slaves were better cared for than the free factory workers Southern preachers proclaimed *that slavery was sanctioned in the Bible* Differences over the slavery issue prompted some Southern churches to break away from the parent group and form sectional denominations

In the House of Representatives Southerners fought back in 1836 by requiring all antislavery petitions to be tabled without reading or discussion John Quincy Adams the ex-president and now a member of the House finally won repeal of the rule in 1844 (*see* Adams John Quincy)

VIOLENCE BEFORE THE CIVIL WAR



In 1859 John Brown s raid on the Harpers Ferry arsenal was blocked by Marines who surrounded the raiders in an enginehouse and forced their surrender

The Fight over Expansion of Slavery

More and more Northerners became convinced that slavery should not be allowed to spread to new territories At the same time Southerners were becoming equally determined to create new slave states For 40 years this issue created an ever widening breach between the South and the rest of the nation The slave states had long been a separate section economically Now they began to regard themselves as a separate social and political unit as well

The first clear evidence of political sectionalism came in 1819

when Missouri asked to be admitted to the Union as a slave state. After months of wrangling Congress finally passed the Missouri Compromise (*see* Clay, Henry; Missouri Compromise).

This measure preserved an uneasy peace for almost a generation. Then in 1848 the acquisition of a great block of territory from Mexico seemed to open new opportunities for the spread of slavery (*see* Mexican War). For a time the North and South were on the verge of war, but finally both parties agreed to accept the Compromise of 1850 (*see* Compromise of 1850). The most disputed provision in the agreement was a law requiring the return of fugitive slaves. Many antislavery people openly flouted this law. They set up "underground railroads" with "stations" where runaway slaves might hide, receive food, and be directed to the next stop on the way to Canada and freedom. Some Northern states passed "personal liberty laws," in an effort to prevent enforcement of this fugitive slave act.

In 1854 President Pierce requested three American ministers in Europe to meet at Ostend, Belgium, to study the problem of uprisings in Cuba. On October 9 the Ostend Manifesto was issued by the three ministers—James Buchanan, John Y. Mason, and Pierre Soulé. This document urged that Spain should sell Cuba to the United States and if this plan failed, then the island should be taken by force. President Pierce's administration rejected this crude attempt to add new slave territory to the Union.

LINCOLN REACHES WASHINGTON

No president-elect ever entered the national capital with less fanfare than was accorded Abraham Lincoln. Because of assassination threats Lincoln left the special train on which he had been traveling and slipped quietly into the city with Col. W. H. Lamon. There he was met by Elihu B. Washburne (behind him).

The differences of opinion over slavery became sharper when Senator Stephen A. Douglas of Illinois persuaded Congress to repeal the Missouri Compromise in 1854 (*see* Douglas). His new measure, the Kansas-Nebraska Act, led to the first armed conflict between North and South—the fighting for control of Kansas (*see* Kansas-Nebraska Act). Three years later the tension between the two regions was heightened by the Dred Scott Decision, which held that Congress had no right to prohibit slavery in federal territories (*see* Dred Scott Decision).

In the North and West many people now began to accept the fact that slavery was morally wrong and that a start should be made toward its extinction. The moderate point of view was best expressed by a tall, gaunt lawyer from Illinois, Abraham Lincoln (*see* Lincoln-Douglas Debates). Extremists such as John Brown wanted direct action. In 1859 Brown led a futile raid on Harpers Ferry, planning to start a Negro insurrection in the South (*see* Brown).

Meanwhile, a new political party, the Republican, had been formed in 1854 to combat the extension of slavery (*see* Political Parties). This party gained strength so rapidly that Southern leaders threatened to secede from the Union if the "Black Republicans" came to power. When the new party did win the elections of 1860 and Lincoln was chosen president, the Southern states, led by South Carolina (Dec. 20, 1860) carried out their threat. By February 1861, six other states of the lower South—Mississippi, Florida, Alabama, Georgia, Louisiana, and Texas—had seceded. (*See also* Confederate States of America; Davis, Jefferson; Stephens.)

Efforts to Save the Union

Many efforts were made to preserve the Union and to prevent bloodshed. The outgoing president, James Buchanan, was devoted to the Union but he believed that the Constitution forbade his taking any action against the South. For several weeks Lincoln also followed a "wait-and-see" course.

In Congress, earnest men sought to find a solution. A Senate committee, headed by John J. Crittenden of Kentucky, prepared an amendment to the Constitution. It provided that the Missouri Compromise line would be extended to the Pacific Ocean and that Congress would be prohibited from interfering with slav-

ery in territories below this line of 36°30′ It also provided that the federal government would pay for slaves who escaped to the North The proposal died, however, when President-elect Lincoln refused his support because it left open the way for the expansion of slavery

Another effort for peace was made by the Virginia legislature, which called a conference of the states at Washington, D C, February 4 Seven slave and 14 free states sent representatives The conference recommended various concessions to the South Congress ignored these suggestions however and instead passed an amendment to the Constitution offered by Senator Douglas This provided that Congress should never interfere with slavery in the states It was not ratified by the necessary number of states and was forgotten when the fighting began

The War Begins at Fort Sumter

When Lincoln became president he took care to avoid all threats of force but he promised to protect 'the property and places" in the South belonging to the federal government One of those places was Fort Sumter in South Carolina Disregarding Lincoln's vow Charleston land batteries opened fire on the fort April 12, 1861 The small federal garrison surrendered the next day The Civil War had begun (*See also* Fort Sumter)

Until the bombardment of Fort Sumter many people in the North and South had been determined to prevent war Some Northerners had argued to 'let the erring sisters go in peace" Many Southerners had opposed secession, and in some of the rebelling states the decision to leave the Union was made only after a close popular vote The attack on Fort Sumter however, ended all hope of peace Lincoln at once called upon the loyal states to furnish 75 000 state militia, and Confederate President Davis asked for 100 000 volunteers from the Southern states Both sections were eager for battle Virginia North Carolina, Tennessee, and Arkansas now joined the Confederacy The four border states—Maryland, Delaware Kentucky, and Missouri—stayed with the North In Virginia, some of the western counties broke away from the 'Old Dominion" and set up a separate government which joined the Union as the state of West Virginia in 1863

Comparison of Rival Forces

In the division of the nation's resources the North fared far better than the South Only 11 states left the Union and 23 (24 with West Virginia) remained loyal The population of the loyal states was about 23 000 000 that of the seceding states, less than 10 000 000, of whom more than a third were slaves.

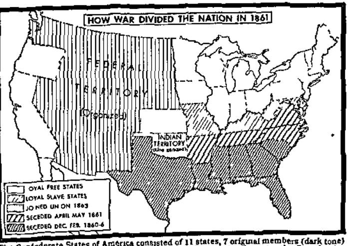
The wealth of the North was estimated at more than twice that of the South (excluding slave property) The North had every type of industry, including about 90 per cent of the total manufacturing of the nation and most of its mineral resources The South was chiefly agricultural with a heavy dependence upon cotton production

The North had more than twice as many miles of railroads as the South It also possessed the means of maintaining effective railroad operation whereas the South did not This was highly important because the Civil War was the first great conflict in which railroads furnished the chief means of transportation On the seas the North retained most of the United States Navy and most of the privately owned merchant vessels The two main assets of the South were (1) its armies fought on interior lines thus lessening transportation and communication problems, and (2) it had expert military leaders notably in the East

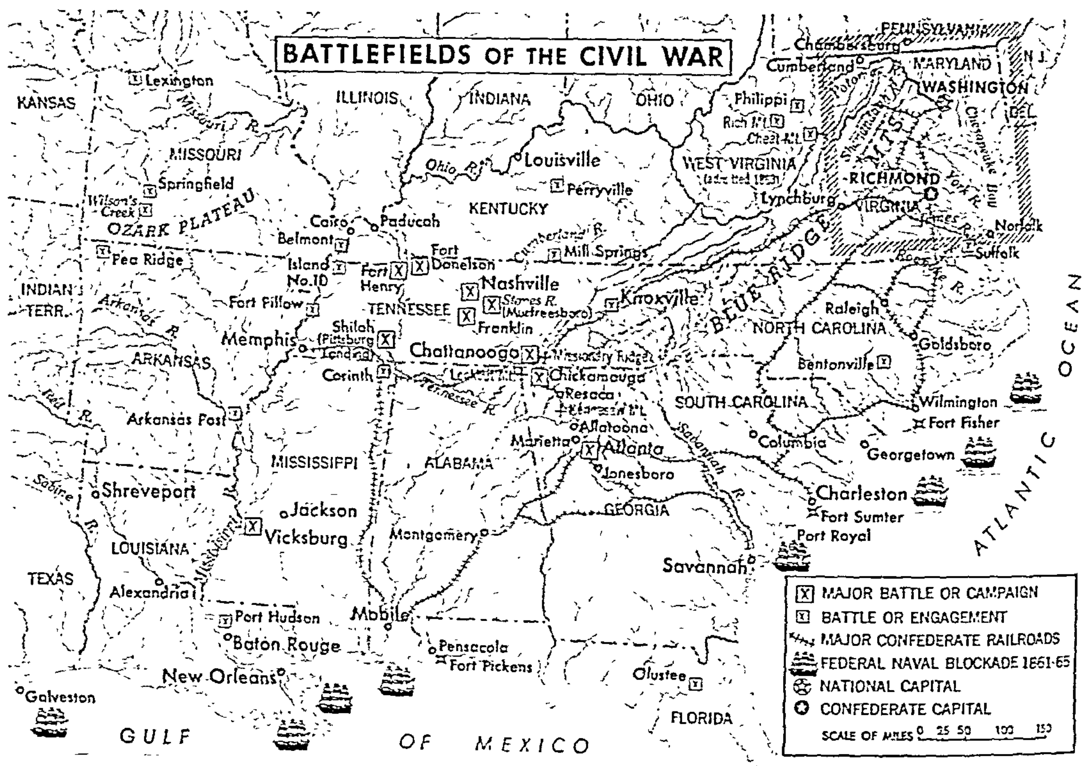
In the beginning both sides tried to raise troops only on a volunteer basis but they soon found it necessary to adopt a military draft The South resorted to conscription in 1862 and the North the following year Both sides also had great difficulty in equipping their troops It was many months before Northern factories were producing enough goods for the Union armies The South with little industrial resources had to import much of its equipment from Europe, running it through the naval blockade imposed by Union vessels throughout the war

The First Year of War

During 1861 both sides hastened to create field armies The first major battle came July 21, 1861, when overconfident *Union forces under Gen Irvin* McDowell were routed at Bull Run (Manassas) by Confederate troops commanded by Gens Joseph E Johnston and Pierre Beauregard (*see* Bull Run) This battle showed that the war could not be fought



The Confederate States of America consisted of 11 states, 7 original members (dark tone) and 4 states that seceded after the fall of Fort Sumter (medium tone) Four border states (light tone) *held slaves* but remained in the Union (shown in white) West Virginia became the 24th loyal state in 1863



without well-trained soldiers. It also indicated that the conflict would probably last a long time.

Throughout the remainder of 1861 the fighting was concentrated in the border states. Federal successes under Gen. George B. McClellan in what is now West Virginia helped keep that territory in the Union (*see* McClellan). Missouri remained loyal due chiefly to the efforts of Capt. Nathaniel Lyon, Gen. John C. Frémont, and the Blair family (*see* Frémont). In Kentucky, Governor Beriah Magoffin attempted to keep that state neutral but without success. Union troops occupied most of Kentucky throughout the war although a rump convention did pass an ordinance of secession late in 1862.

By the end of 1861 two major battlefronts had developed. One was in the East where Virginia, Maryland, and Pennsylvania suffered the bulk of the fighting. The other front was in the West, at first along the Mississippi River and then later around Chattanooga, Tenn., and in northern Georgia.

The War in the East, 1862

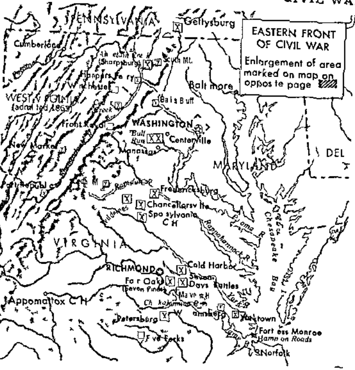
On the Eastern front each side tried to capture the opposing capital. General McClellan, the first Union commander here, was a great drillmaster but a timid warrior. He was repeatedly outmaneuvered by the Confederate commander, Gen. Robert E. Lee, who proved to be one of the greatest military leaders of all time (*see* Lee, Robert E.).

In the spring of 1862 McClellan brought his Army of the Potomac by water as far as Fortress Monroe, Va. He planned to take Richmond by moving up the narrow peninsula between the York and James rivers. McDowell's troops, held at Fredericksburg in defense of Washington, were to be held in reserve. The campaign got off to a slow start. The Army of the Potomac was delayed a month besieging weakly held Yorktown and then was halted again at the battle of Fair Oaks (Seven Pines), May 31–June 1. When McClellan was almost ready to attack Richmond, McDowell was ordered away to the Shenandoah Valley.

In the Shenandoah Valley Confederate Gen. "Stonewall" Jackson had routed Northern troops in a lightning advance on Harpers Ferry. From this point his "foot cavalry" seemed to threaten Washington itself (*see* Jackson, Thomas J.). Jackson then slipped away and hurried his men by train to Richmond. Here Lee had sent Gen. J. E. B. Stuart on a cavalry raid which brilliantly encircled McClellan's forces (*see* Stuart, James E. B.). Lee then took the offensive. He drove McClellan back in the Seven Days battles, ending at Malvern Hill, July 1, 1862.

Alarmed by Union failures, President Lincoln placed Gen. Henry W. Halleck in command of all Federal armies. Halleck ordered McClellan to abandon his Peninsular Campaign and to unite with the Union forces in northern Virginia, then led by Gen. John Pope. Before Pope could be reinforced, Jackson's corps and Lee's other corps under Gen. James Longstreet routed the Federals in the second battle of Bull Run, August 28–30.

Lee now crossed the Potomac to invade Maryland. He wanted to transfer the fighting to Northern soil



The map at the left shows the major battle areas and strategic points in the Civil War. The map at the right is an enlargement of the eastern front scene of the bloodiest fighting. In the climactic year of 1863 Union armies knifed deep into the South to open the Mississippi River and to win control of all the Chattanooga area. At the same time Lee's chief Northern thrust was turned back at Gettysburg. These victories doomed the Confederacy. Contributing to the Union triumph was the naval blockade of major Southern ports and the weaknesses of the Confederate railroads.

and at the same time to influence the coming Congressional elections against Lincoln. To protect his rear Lee sent Jackson to capture Harpers Ferry. Meanwhile McClellan who had succeeded Pope accidentally obtained a copy of Lee's general orders. He advanced to meet Lee along Antietam Creek at Sharpsburg. While McClellan hesitated for a whole day Jackson with three divisions made a forced march up from Harpers Ferry. When the Union troops finally did attack on September 17 they met most of Lee's reunited forces. Late that afternoon Gen A P Hill's division arrived from Harpers Ferry just in time to prevent a possible decisive Union victory (*see* Antietam).

From Antietam to Gettysburg

The Union victory at Antietam slight though it was gave President Lincoln the opportunity to issue the Emancipation Proclamation. This decreed the freedom of all slaves in territory still in rebellion on Jan 1 1863 (*see* Emancipation Proclamation). The president took this momentous step to introduce a new moral aim in the war and to prevent foreign intervention.

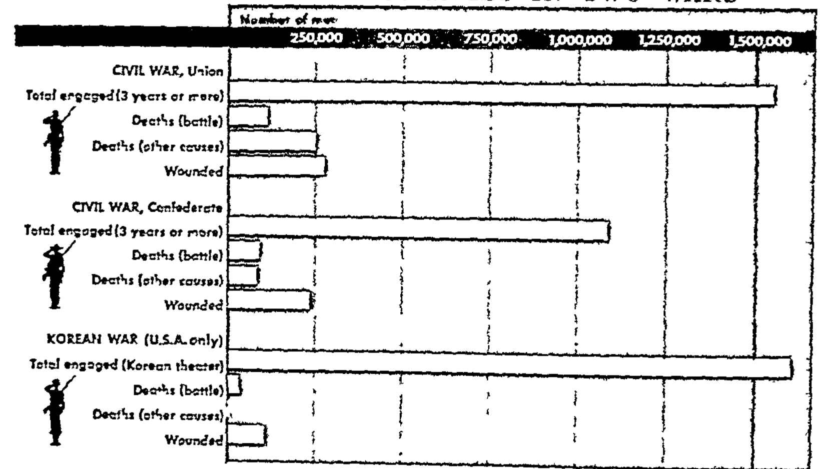
Then Lincoln began a long search for a general to cope with the brilliant Lee. McClellan was relieved because he had "the slows" as Lincoln phrased it. He was replaced by Gen Ambrose Burnside who led the Army of the Potomac to a disastrous defeat at Fredericksburg Va Dec 12 1862 (*see* Fredericksburg). The next choice Gen "Fighting Joe" Hooker fared little better at Chancellorsville May 2 3 1863 although the death of Jackson here was a severe blow to the Confederacy (*see* Chancellorsville). Now Lee again invaded the North advancing into Pennsylvania. At Gettysburg July 1 3 1863 Lee suffered his first stinging defeat but the North failed to follow up the advantage. The hesitant Union leader was Gen George G Meade who had relieved Hooker just before the battle (*See also* Gettysburg; Hancock Winfield S; Meade.)

Campaigns in the West 1862-64

Throughout the war the Federal forces were more successful in the West. In February 1862 Gen Ulysses S Grant advanced into Tennessee (*see* Grant). He captured Fort Henry on the Tennessee River with the aid of Commo A H Foote and his gunboats then crossed to the Cumberland to take Fort Donelson. After a desperate battle at Shiloh April 6–7 1862 he cut the Confederate railway communications with the East at Corinth Miss (*see* Shiloh). In this battle the able Southern general Albert S Johnston was mortally wounded. While Shiloh was being fought Gen eral Pope's men and Foote's gunboats seized Island Number 10 an important Confederate fort on the Mississippi River. A few weeks later Commo David G Farragut ran his fleet past the batteries at the mouth of the Mississippi River paving the way for the occupation of New Orleans by Union forces on May 1 1862 (*see* Farragut).

It was not until more than a year later however that the Mississippi was completely opened. On July 4 1863 as Lee was retreating from his disastrous defeat at Gettysburg Vicksburg fell to General Grant after a desperate siege (*see* Vicksburg). Five

COMPARISON OF CASUALTIES IN TWO WARS



In the Korean fighting casualties were far fewer than for either side in the Civil War, largely because of: (1) the greatly increased number of service and supply troops; and (2) the great advances in medical science which reduced sharply deaths from wounds and from disease.

days later Port Hudson, the last Confederate river fort, surrendered.

To the East, Confederate Gen. John H. Morgan led a raiding party into Kentucky in July 1862. The following summer he swept into Indiana and Ohio before his force was defeated and captured. Other raiders under Gen. Nathan B. Forrest destroyed Federal stores and lines of communication in Tennessee. The Southern Army of Tennessee under Gen. Braxton Bragg invaded Kentucky in September 1862 but was turned back by Gen. D. C. Buell's Union army at Perryville on October 8.

Bragg withdrew to central Tennessee, pursued by the Union army now commanded by Gen. W. S. Rosecrans. At Murfreesboro (Stones River) he was defeated again, December 31–January 2, and retreated to Chattanooga. Six months later Bragg gave up Chattanooga without a struggle. He was then reinforced by Longstreet's corps from Virginia. At Chickamauga, Ga., Sept. 19–20, 1863, the combined Confederate forces lashed back at the Union troops. The battle might have been a major Federal disaster but for the firm stand taken by Gen. George H. Thomas and his men (*see* Thomas).

Thomas now replaced Rosecrans, and Grant was brought from Vicksburg to take supreme command of the Union forces in the West. In fighting around Chattanooga, November 23–25, the main Confederate army in the West was driven from Tennessee (*see* Chattanooga, Battle of). Under Gen. Joseph Johnston and later Gen. J. B. Hood the Confederates retreated toward Atlanta fighting a series of delaying actions. In direct command of this Union drive was Grant's ablest lieutenant, Gen. William T. Sherman (*see* Sherman).

The Final Phase, 1864–65

In March 1864, Grant became commander in chief of all Federal armies and moved his headquarters to Virginia. Seeing that the long fighting had severely weakened Lee's forces, Grant began a relentless campaign of increased attrition. He forced bloody but inconclusive battles at the Wilderness, May 5–6; Spotsylvania, May 8–12; and Cold Harbor, June 1–3. He then circled Richmond and laid siege to the important railroad junction of Petersburg, Va.

In July 1864, Lee sent Gen. Jubal Early raiding in Shenandoah Valley, hoping to repeat Jackson's successes of 1862. Early, however, was routed by Gen. Philip Sheridan's cavalry who then ravaged the valley, destroying Confederate food supplies (*see* Sheridan).

In Georgia, Sherman's Army of the West had captured Atlanta, Sept. 2, 1864, and then marched on to the sea, leaving behind a swath of waste and destruction 60 miles wide. Sherman reached Savannah December 20. Meanwhile Confederate General Hood, attempting a counterattack in Tennessee, was decisively defeated at Franklin November 30 and at Nashville December 15–16.

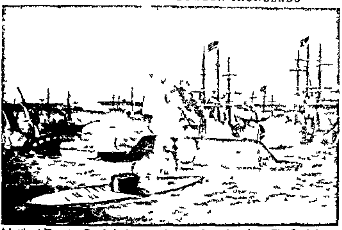
From Savannah, Sherman turned northward to join forces with Grant. This pincer movement against Lee proved unnecessary, however. A Federal victory at Five Forks, Va., April 1, 1865, forced Lee to abandon both Petersburg and Richmond and flee westward. Finally, with his army depleted and his supplies exhausted, Lee surrendered to Grant at Appomattox Court House, Va., April 9. Sherman took the surrender of Joseph Johnston's army in North Carolina April 26. On May 4 Gen. Richard Taylor surrendered the Confederate forces in Mississippi and Alabama. Three weeks later Gen. Kirby Smith surrendered the trans-Mississippi forces in Texas. The war was over.

The War at Sea

Early in the war President Lincoln proclaimed a blockade of the entire Southern coast line, and by pressing all kinds of ships into use, severely curtailed Confederate shipping (*see* Blockade). Southern efforts to break the blockade were in vain. The chief hope, the *Merrimac* (*Virginia*), could get no better than a draw in its famous battle with the *Monitor* in 1862 (*see* 'Monitor' and 'Merrimac').

Several commerce destroyers were built in England for the Confederacy. They did much damage to Northern shipping but they could not raise the blockade. Gradually the Union tightened its grip on the seas by capturing the Southern ports through which blockade runners smuggled supplies. New Orleans fell first, in 1862. In 1864 Farragut's warships took Mobile harbor. The next year Fort Fisher, guarding Wilmington's harbor, was stormed by Comdr. David Porter's fleet co-operating with land forces under

THE FIRST BATTLE BETWEEN IRONCLADS



A battle at Hampton Roads in 1862 revolut onized naval warfare The Confede ate ironclad *Merrimac* renamed the *Virgin a* began destroying the wooden Union fleet until driven off by the Federal *Mon tor* (foreground) another gunboat encased in iron

Gen A H Terry (*see* Porter David D) A little more than a month later Sherman s capture of Charleston sealed off the last major port

Foreign Affairs During the War

At the beginning of the war the South counted heavily on foreign intervent on It believed that European nations particularly England must have Southern cotton for their industries and that if necessary they would fight the North to get it In 1861 the Confederacy dispatched two agents to Eng land and France but Federal warships took them off a British sh p as prisoners of war This incident nearly involved the United States and Great Britain in war (*see* Trent Affair)

The Union protested to Great Br tain about the commerce destroyers which the British government permitted to be built in local shipyards The most fa mous of these vessels was the *Alabama* commanded by Capt Raphael Semmes (*see* Alabama Claims) Other difficulties arose from the enforcement of the Federal blockade Fortunately neither Britain nor the United States wante l war and when British workingmen learned that the Union was fighting for the cause of free labor their sympatl es were all with the North England found other sources of supply for cotton and profited from trade as a neutral

France however was openly hos tile to the United States Napoleon III even sponsored an expedition to Mexico aimed at mak ng that repub l c a atellite state of France The p ippet Mex can emperor Archduke Maximilian of Austria was executed for his trouble in 1867 (*See also* Mexico)

War on the Home Front

One of the big problems on the home front was the large group of Northerners who opposed the war These copperheads as they were called organized secret soc et es such as the Kn ghts of the Gol len C rcle They sought to embarrass the government by discourag ng enlistments opposing the draft and even helping Confed erate prisoners to escape Copperheads became influential in the Democrat c party and in the elections of 1862 scored important victor es in Illino s Indiana and Iowa

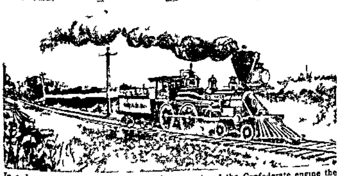
In 1864 the peace-at-any price element wrote the Democratic platform calling for an immediate en l to the war They nominated General McClellan for the r pres dential cand date but he came out openly for winning the war Pre ident Lincoln was renominated by the Republicans under the label of Union party Although the popular vote was close Lincoln carried all but three states—New Jersey Delaware and Ken tucky Voting for the first time was Nevada admitted as a state Oct 31 1864 Much of Lincoln s success was due to Sherman s timely victories in Georgia

To the great misfortune of both North and South President Lincoln served but six weeks of his second term He was shot by John Wilkes Booth April 14 1865 and died the following day less than a week after Lee s surrender

Tl e victory of the Federal forces established that no state could secede from the Un on or even nullify a nat onal law The war paved the way for the adoption of the 13th Amendment which forbade the use of slave labor in the United States (*see* Un ted States Const tution)

After the war the Un ted States faced grave problems of readjustment and reconstruction The econom c social and pol tical outgro ths of the war are discussed in Reconstruct on Per od (*See also* United States History)

THE PURSUIT OF THE GENERAL



In a daring raid in 1862 22 Union sold ers captured the Confederate engine the *General* They were finally caught by pursuers in the engine *Texas* (far left)

CLAMS AND MUSSELS. Along the Atlantic coast of North America clams are eaten by more people than any other shellfish, probably because they can be gathered along the beaches by amateurs as well as by commercial fishermen. When the Pilgrims landed at Plymouth, the Indians taught them to dig clams in the sand flats. Many a time this lesson kept a Pilgrim family from going hungry. A favorite picnic of shore towns today is the clambake. The clams, along with corn, potatoes, and fish or chicken, are roasted in a hole in the beach, lined with hot stones and packed with freshly gathered seaweed.

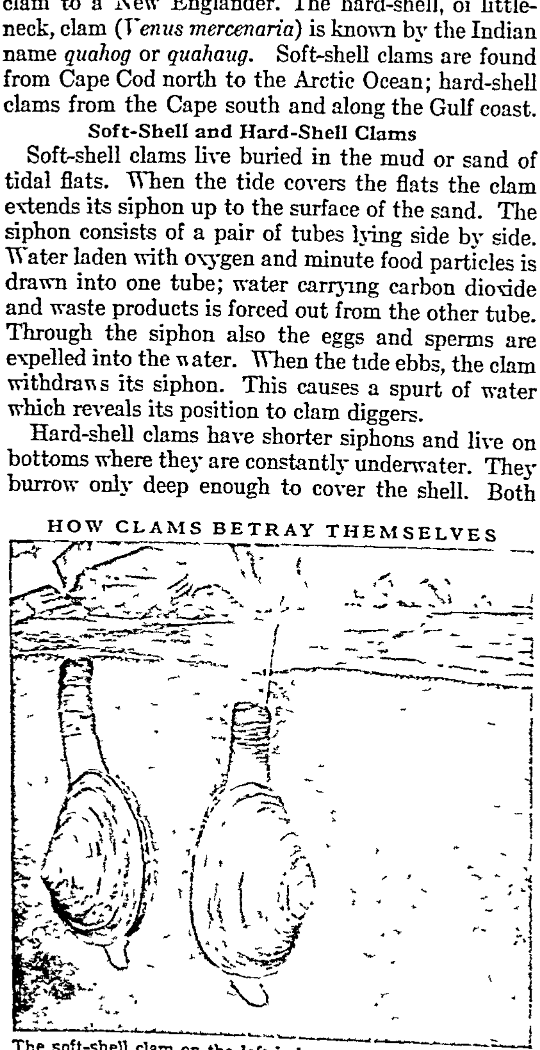
Clams are mollusks of the bivalve group; that is, they have two shells connected by a muscular hinge (*see* Mollusks). Two kinds of clams comprise most of the production along the Atlantic coast. The soft-shell, or long-neck, clam (*Mya arenaria*) is the only true clam to a New Englander. The hard-shell, or little-neck, clam (*Venus mercenaria*) is known by the Indian name *quahog* or *quahaug*. Soft-shell clams are found from Cape Cod north to the Arctic Ocean; hard-shell clams from the Cape south and along the Gulf coast.

Soft-Shell and Hard-Shell Clams

Soft-shell clams live buried in the mud or sand of tidal flats. When the tide covers the flats the clam extends its siphon up to the surface of the sand. The siphon consists of a pair of tubes lying side by side. Water laden with oxygen and minute food particles is drawn into one tube; water carrying carbon dioxide and waste products is forced out from the other tube. Through the siphon also the eggs and sperms are expelled into the water. When the tide ebbs, the clam withdraws its siphon. This causes a spurt of water which reveals its position to clam diggers.

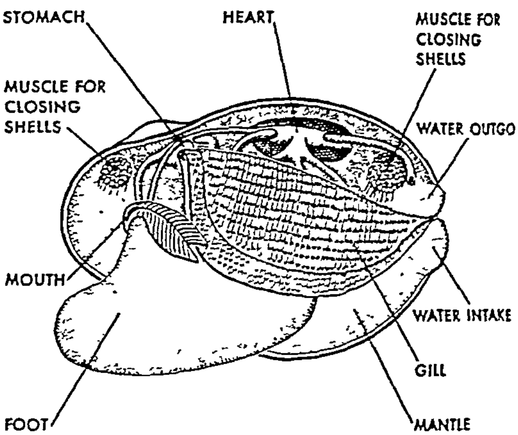
Hard-shell clams have shorter siphons and live on bottoms where they are constantly underwater. They burrow only deep enough to cover the shell. Both kinds have a fleshy, wedge-shaped foot with which they burrow and move from place to place.

HOW CLAMS BETRAY THEMSELVES



The soft-shell clam on the left is in normal position. The one on the right is drawing in its siphon. The resulting waterspout reveals its location to clam diggers.

ANATOMY OF A FRESH-WATER CLAM



Fresh-water clams lack the siphon of the marine clams. Both kinds have a digging foot, and the internal organs are similar.

The eggs and sperms of the hard- and soft-shell clams are discharged into the water where fertilization takes place. Within 10 or 12 hours a free-swimming larva hatches from an egg. The larva is about 1/300 of an inch long. In three to six days it sinks to the bottom. There it spins a thread called a byssus and anchors itself to a stone, shell, or bit of seaweed. It is now about the size of a grain of sand and the shell is very thin. When the shell is about one-quarter inch long the clam begins to burrow into the sand. Finally the gland in the foot which secretes the byssus thread is absorbed, and the mature clam never again leaves its burrow unless it is disturbed. Few clams in their early defenseless stages escape being eaten by other forms of marine life. Clams reach a marketable size of two and a half inches in about two years.

Commercial fishermen take soft-shell clams by digging with special hand diggers. Hard-shell clams, in the large beds off the Gulf coast of Florida, are taken by dredges to which a rakelike digging apparatus is attached. Indian money called "wampum" was made from the hard shell of the quahog. The dark purple spot at the hinge was the part used. The shell was rubbed on a stone until only a purple bead remained.

Important salt-water commercial clams on the Pacific coast are the littleneck clam (*Paphia staminea*), the butter clam (*Saxidomus nuttali*), and the razor clam (*Siliqua patula*). The razor clam, found from the Sea of Okhotsk to Monterey, has a long, elliptical shell with a sharp edge. The United States catch of clams is marketed fresh and as canned clams or clam chowder. Large quantities are also used as fish bait.

Fresh-Water Clams and Salt-Water Mussels

Fresh-water clams and salt-water mussels belong to another, but closely related, group. They differ from the hard- and soft-shell clams in several ways. They have imperfectly developed siphons. The inner shell is pearly instead of porcelainlike. The gills are formed in a different manner. The eggs are fertilized in the

THE WORLD'S LARGEST SHELLFISH

The giant tridacna clam of the South Pacific and Indian oceans has been known to trap unwary pearl divers in its huge shell.

gills where the larvae hatch After the larvae of fresh water clams are expelled into the water they attach themselves to the fins or gills of fishes where they complete their development Salt-water mussels sink to the bottom where they attach themselves by the byssus to rocks or other mussels Unlike adult hard and soft-shell clams they retain the byssus

One kind of mussel (*Mytilus edulis*) is a popular food in Europe The fresh water clams of the Mississippi River are commercially important as the source of shells from which 'pearl' buttons are made (*see* Buttons) True pearls are sometimes found in these clams

The geoduck, or gweduck (*Glycymeris generosa*) is a great clam found in Puget Sound It may measure three feet from shell tip to siphon tip The giant tridacna clam (*Tridacna gigas*) of the coral islands in the East Indies and the Pacific Ocean is the largest shell fish known Some specimens weigh 400 pounds or more and are said to live as long as a hundred years

Clams and mussels belong to the class *Pelecypoda* (hatchet foot) of the phylum *Mollusca* (*see* Mollusks) Soft-shell clams belong to the family *Myacidae* hard shell clams to the family *Venenidae* razor clams to the family *Solenidae* all of which are in the order *Teleodesmacea* Fresh water clams belong to the family *Unionidae* salt-water mussels to the family *Mytilidae* both of which are in the order *Prionodesmacea*

CLARK, GEORGE ROGERS (1752–1818) The vast region now occupied by the five states of Ohio, Michigan Indiana Illinois, and Wisconsin was won for the United States by the vision and daring of one man George Rogers Clark

When the American Revolution broke out, Clark knew, as did the British, that in the wild country west of the Allegheny Mountains victory depended largely upon which side the Indians took The British were stirring the Indians up to attack the American settlements Clark knew the only way to prevent this was to drive the British from their posts He therefore raised a force of about 175 men and in the summer of 1778 brought under the American flag three important British posts—Kaskaskia and Cahokia, on the Mississippi River near St Louis and Vincennes on the Wabash River

A Desperate Venture

While Clark was wintering at Kaskaskia after inducing the chief tribes of the western country to sign a treaty of peace he learned that a British expedition under Henry Hamilton lieutenant governor at Detroit had retaken Vincennes Clark decided that he could beat Hamilton only by catching him off guard with a surprise winter attack before fresh troops could reach him in the spring On Feb 7, 1779 he set out on this desperate venture

For much of the march of 180 miles, the men had to wade through icy swamps and rivers holding their rifles above their heads Toward the end they ran out of food On February 23 Clark and 130 men reached the Wabash That night they surrounded Fort Sackville the British post at Vincennes and opened a deadly fire with their long Kentucky rifles Next day Hamilton deceived into thinking the American force larger than it was surrendered Thereafter the British only had men enough in the west to hold the Great Lakes region and the Americans were able to claim all this western land when the Revolution ended (*see* Revolution American)

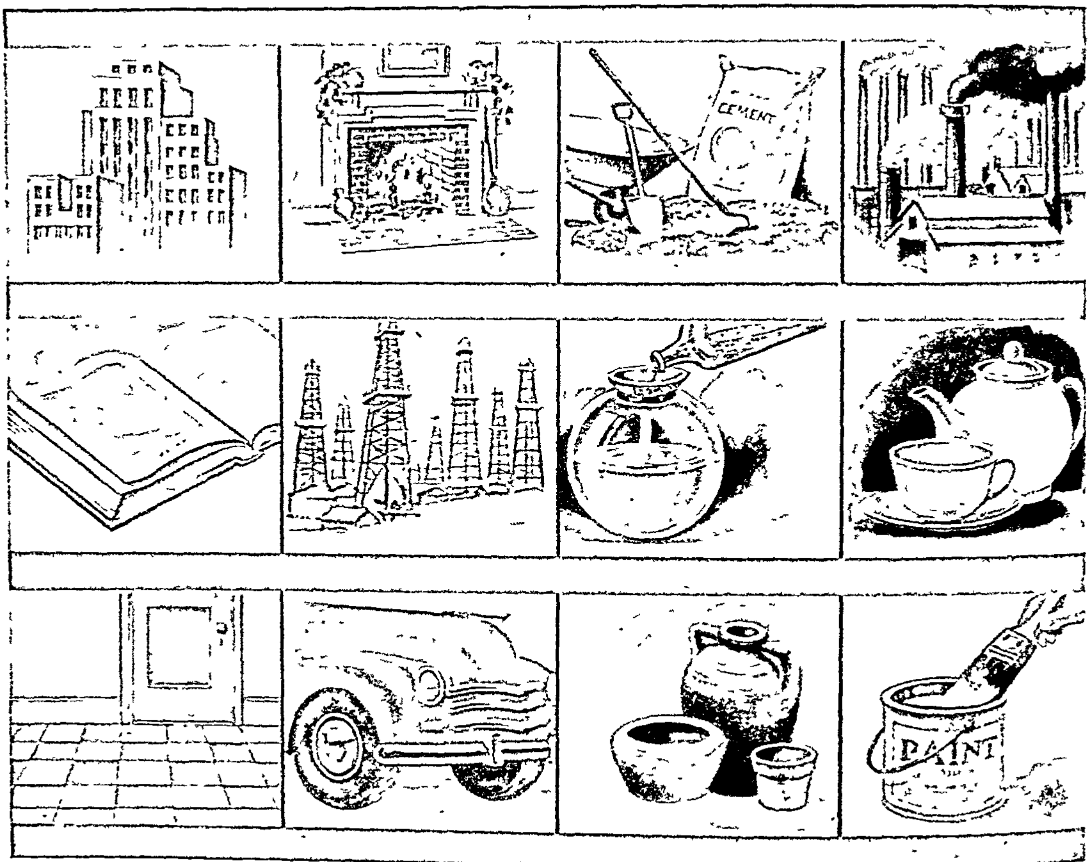
Clark's Early Life and Later Career

Clark was born on a Virginia plantation Nov 19, 1752 At the age of 22 he was a surveyor in the Kentucky country then a part of Virginia He gained military experience in Lord Dunmore's War of 1774 against the Indians (*see* Sevier) After the Revolution broke out he persuaded *Patrick Henry, governor of* Virginia to let him raise a force and try out his plan, though he was only a youth of 25 After the war, Virginia made him a brigadier general and gave him a grant of land but never paid nearly $20 000 due him for the expenses of his troops and his own pay For a time he served as land commissioner but lost this position as the result of intrigue

Clark spent his declining years in poverty on his land at Clarksville Ind , aided only by $400 a year which Virginia granted him for life in 1812 He died Feb 13, 1818 in his sister s home at Locust Grove, near Louisville Ky where he is buried A splendid building was erected in Vincennes in 1931 as a memorial to him The William Clark of the Lewis and Clark Expedition was his younger brother (*see* Lewis and Clark Expedition)

CLAY In prehistoric times men found that clay could be molded and then baked hard Thus they learned to make pottery vessels to hold food and drink They used clay also to daub the walls of their huts, later they made brick from clay Clay is still one of our most useful raw materials Portland cement

COMMON CLAY HAS MANY IMPORTANT USES



These pictures suggest the leading uses for clay products. Top row: In building materials, various clays enter into common and face brick, drain pipe, roofing tile, terra cotta, plaster, and cement. Special fire and stoneware clays furnish linings for industrial ovens and furnaces. Middle row: Good paper is filled and glazed with china clay. Oil wells use clay in rotary drilling. Various oils are filtered and decolorized with bentonite and fuller's earth. Chinaware is made of china clay, or kaolin. Bottom row: China clay supplies us with high-grade tile. Rubber products such as tires may also use china clay. Pottery and stoneware are made of ball, fire, and stoneware clays. Paint is filled and extended with china clay.

has clay in its composition. Bricks and drain pipes are clay mixtures which have been baked in great heat. Pottery, from the heaviest mixing bowls to the most fragile porcelain tea service, is made of clay. Clay is also used for glazing paper, in making insecticides, and for clarifying food products, wines, vinegar, and cider.

Composition and Properties of Clay

The properties that early man discovered in clay and that make it so useful today arise from the fact that clay is composed of small particles, many of which can be seen only with an ultramicroscope. The smallest particles are colloidal; they can hold a film of water, firmly bound or adsorbed on the surface, by electrical attraction (*see* Colloids). This water acts as a lubricant which enables the particles to slip easily past one another; hence wet clay is plastic. Baking drives off water; the particles adhere to one another; and the baked object becomes hard and watertight. The jelly-like surface of the colloidal particles absorbs dyes and grease, a quality which makes clay useful in laundries. Water causes clay to expand, and certain types are used in stopping leaks in engineering works. A certain amount of clay is necessary in good soil, because it prevents water from draining completely away (*see* Soil).

We all know the biblical story of the captive Israelites in Egypt who were forced to make bricks without straw. Dr. E. G. Acheson, a distinguished American inventor, wondered if straw did make a difference in the quality of bricks. He boiled some straw, mixed the resulting liquid with clay and found that the plasticity was greatly increased. The active agent was tannin, and clay treated with tannin is called "Egyptianized clay."

Formation and Varieties

Clay is an earthy substance formed by the decomposition of certain rocks. Pure clay consists chiefly of silica and alumina, but most clays contain impurities which give the different kinds their distinctive qualities. It is one of the most widely distributed of all materials. During the Ice Age glaciers accumulated vast quantities of clay, and when they melted they left large deposits. Many deposits stayed where the glaciers left them; others were carried by streams and rivers to continental edges or to river deltas. When beds of clay are solidified by pressure and heat beneath other sediments they form the rock known as *shale*. Ground-up shale mixed with water becomes clay again. *Slate* is a laminated variety of rock formed by the great compression of shale.

Pottery is made chiefly from *ball clay* and *kaolin* or china clay, both of which are fine highly plastic and nearly white when burned Ball clay is found in Kentucky New Jersey and Tennessee Kaolin derived its name from the Chinese word *kao-ling* (lofty hill) the name of a hill in China from which deposits were first taken The United States mines about half the kaolin in use chiefly in the southeastern states but extensive deposits also occur in England France and Germany *Brick clays* include almost any impure clay that can be made into bricks *A mixture* containing a large percentage of lime makes cream colored brick while one containing considerable iron burns red Many bricks are made from ground up shale Paving brick requires a clay that contains a high percentage of lime iron and an alkali in order that it may glaze well in burning *Bentonite* used largely in steel mills in oil well drilling and in foundries has a higher colloidal content than most other clays It occurs in many states but is mined chiefly in Wyoming and South Dakota *Adobe* clay has been used since ancient times for making sun-dried brick

CLAY, HENRY (1777–1852) For 40 years Henry Clay exercised a leadership in the politics of the United States that has seldom been equaled He was a man of charming personal traits, powerful emotional oratory, and brilliant statesmanship, and he was greatly loved and honored by hundreds of thousands of his fellow countrymen But like his great contemporaries Calhoun and Webster, he failed to gain the presidency and repeatedly saw that prize go to men of lesser powers In part the explanation of this lies in the honesty and patriotism of his policies which created enmities which less prominent men escaped

HENRY CLAY
Great Orator and Political Leader

Clay was born on a frontier farm in the western part of Virginia, in a low swampy neighborhood called "the Slashes" He attended school irregularly in a one-room log-cabin schoolhouse, and helped his widowed mother between times by plowing the fields and carrying to the mill the harvested grain In after-days he was often called the 'mill boy of the slashes" Encouraged by his stepfather, he studied law and was admitted to the bar when 20 years of age Shortly afterward he removed to Kentucky, where his great gifts of leadership and eloquence soon won for him a place in the Kentucky Legislature After two years of brilliant service he was chosen to fill a vacancy in the United States Senate (in 1806), and although he had not yet reached the legal age of 30 he was permitted to take his seat In 1811 he was elected to Congress, and on the very first day of the session was chosen Speaker of the House With the exception of one term which he refused, he remained representative and Speaker for the next 14 years

Throughout his political career Clay took an active part in the measures of the day He advocated a protective tariff and favored a policy of "internal improvements"—that is, road making canal building, and the like, by the national government—on a wide scale throughout the country This he called "the American system" In the beginning of his career he especially distinguished himself by *his energy in* bringing about war with England Ably supported by *John C* Calhoun, the two "war hawks," as they were called, by their combined eloquence persuaded a reluctant Congress and President to a declaration of hostilities against Great Britain in 1812 At the end of a rather inglorious war Clay was chosen one of the commissioners who drafted the treaty of Ghent By a curious turn of fortune the conflict so zealously advocated by Clay, brought forth as *its chief hero* General Andrew Jackson, the man who later on was *to prove the chief obstacle between Clay and the* White House

An unfortunate circumstance connected with Clay's first candidacy for the presidency reflected unhappily on the rest of his public life In the election of 1824 he was one of four candidates, none of whom received a majority of votes In such an emergency the choice of president rests with the House of Representatives Clay stood fourth on the list and, in accordance with the Constitution, was dropped from the list of candidates Crawford, another candidate had been stricken with paralysis The choice therefore lay between John Quincy Adams and Andrew Jackson, the two remaining candidates Clay used his influence in favor of Adams who was elected When Adams appointed Clay to be his secretary of state the charge of "bargain and corruption' was at once raised by Jackson's friends In fact there was no shred of evidence on which it could rest But eccentric John Randolph of Virginia spoke openly in Congress of 'the coalition of the Puritan with the black leg", and referred to Clay as "this being, so brilliant yet so corrupt, which, like a rotten mackerel by moonlight, shined and stunk " Clay immediately challenged Randolph to a duel After ineffective shots by both, Randolph fired his pistol in the air with the remark, ' I do not fire at you, Mr Clay " Thus ended what Benton called "the last high toned duel I have witnessed " The ' bargain charge," in spite of its injustice, followed Clay to the grave

In 1832 and in 1844, Clay was again a candidate for the presidency but was defeated, first by General Jackson and then by James K Polk This third defeat, by a man whom Clay had ridiculed, was not very gracefully received In 1840 and in 1848 Clay had sought the presidency but was defeated in the Whig party convention, first by General Harrison and then by General Zachary Taylor

In addition to 12 years in the House of Representatives, Clay served for almost 20 years in the Senate It was here that he earned the name of the Great Pacificator by finding solutions for numerous controversies between North and South

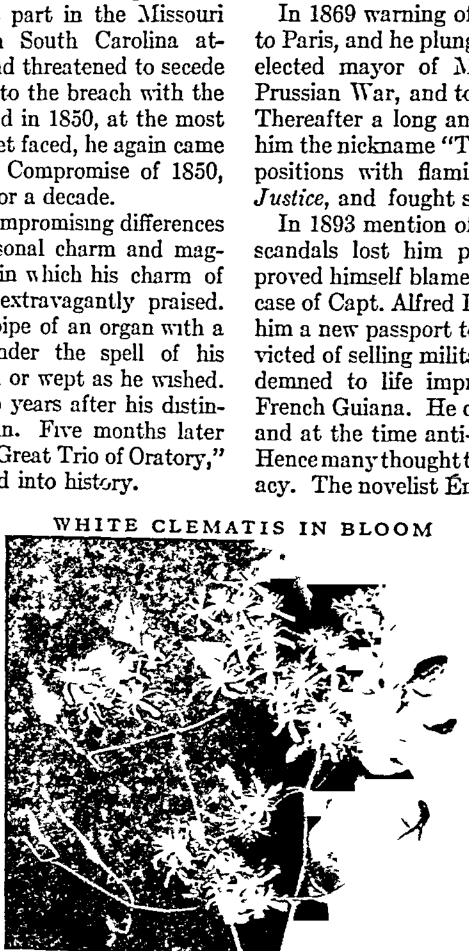
Three times Clay was able by his compromises to bring about concessions which while satisfying neither North nor South delayed the inevitable struggle. In 1820 while still Speaker of the House of Representatives he played an important part in the Missouri Compromise. In 1833 when South Carolina attempted to nullify the tariff and threatened to secede from the Union, he stepped into the breach with the compromise tariff of 1833. And in 1850, at the most severe crisis the country had yet faced, he again came forward as the author of the Compromise of 1850, which delayed the Civil War for a decade.

Much of Clay's success in compromising differences was doubtless due to his personal charm and magnetism. Anecdotes were told in which his charm of manner and personality were extravagantly praised. His voice was likened to the pipe of an organ with a thousand variations, and under the spell of his eloquence vast crowds laughed or wept as he wished.

Clay died in June 1852, two years after his distinguished contemporary Calhoun. Five months later Daniel Webster died, and the "Great Trio of Oratory," as the three were called, passed into history.

CLEM'ATIS. Among all climbing plants there is none more attractive than the clematis, with its white or purple blossoms. When it has gone to seed it is more attractive still. Its gray silky tufts of seed clusters look like wreaths of leaf smoke puffing over the vine. When they are ripe the wind catches the long slender plumes, and they carry the seeds far and wide.

WHITE CLEMATIS IN BLOOM



This spray of white clematis in bloom suggests the delicate appeal of the flowers.

One largely cultivated variety is the white clematis, or virgin's bower, which is covered with sprays of fragrant white blossoms. The well-known blue clematis, with its handsome large purplish blossoms, came originally from Japan. It needs a rich soil.

The clematis is a genus of the crowfoot family (*Ranunculacae*). About 20 to 150 known varieties grow in the United States. The flower clusters are generally blue or white. Scientific name of virgin's bower, *Clematis virginiana;* blue clematis, *Clematis florida.*

CLEMENCEAU (*klā-mäṅ-sō'*), **GEORGES BENJAMIN EUGÈNE** (1841–1929). "The man who saved France in the hour of her deadliest peril!" Georges Clemenceau was a white-haired old man of 77 when he won this acclaim. He did so by accepting the position of prime minister in 1917, when France seemed about to lose the first World War, and holding the country in the fight until victory came the next year.

Clemenceau was born in Brittany Sept. 28, 1841. He studied medicine, but was imprisoned before he was 20 for shouting "Long live the Republic!" in Paris during a celebration in honor of Emperor Napoleon III. Upon being released he came to the United States. He practised medicine in New York City, then taught French in a girls' school at Stamford, Conn. There he married Mary Plummer, but they were divorced.

In 1869 warning of a political crisis drew him back to Paris, and he plunged into a public career. He was elected mayor of Montmartre during the Franco-Prussian War, and to the General Assembly in 1871. Thereafter a long and stormy political career earned him the nickname "Tiger." He supported his political positions with flaming editorials in his paper *La Justice*, and fought seven duels before he was forty.

In 1893 mention of his name in the Panama Canal scandals lost him political favor, even though he proved himself blameless. But in 1896–97 the famous case of Capt. Alfred Dreyfus of the French army gave him a new passport to power. Dreyfus had been convicted of selling military secrets to Germany and condemned to life imprisonment on Devil's Island in French Guiana. He came of a wealthy Jewish family, and at the time anti-Semitism was strong in France. Hence many thought that he was the victim of a conspiracy. The novelist Émile Zola wrote for Clemenceau's journal, *L'Aurore*, a famous article 'J'Accuse' (I Accuse). The case was reopened and in 1906 these two won their fight for vindication of Dreyfus.

This success brought Clemenceau a new political career. *L'Homme Libre* (The Free Man) his newspaper, was suppressed in September 1914; but it reappeared two days later as *L'Homme Enchaîné* (The Man in Chains). Three years later came the call to save France.

An anarchist fired two bullets into Clemenceau on Feb. 10, 1919, but he recovered in three weeks and continued to preside at the peace conference. In 1922, at the age of 81, he toured the United States to urge coöperation with Europe. He died in 1929.

CLEOPA'TRA (69–30 B.C.). Many legends cluster about this fascinating queen of Egypt. Because she captured the hearts of two of the greatest men of her day, and brought one of them to ruin, Cleopatra has gone down in history as a heartless, scheming siren. But she had many other qualities. One historian says of her, "She was not especially beautiful, but she had a wonderful voice and the seductiveness which attracts men; and she was intensely alive, tireless, and quite fearless . . . Apart from her attractions she was highly educated, interested in literary studies, and conversant with many languages."

Cleopatra was part Macedonian and part Greek, not Egyptian. Upon the death of her father, Ptolemy XI, she became, at the age of 17, joint ruler with her

ten year-old brother Ptolemy XII Three years later she was driven from the country by an uprising in the interests of her brother and his advisers

At this time Egypt was an independent ally of Rome Shortly after Cleopatra s flight Julius Caesar reached Egypt in pursuit of his enemy Pompey (*see* Caesar Julius Pompey the Great) When Cleopatra heard that Caesar was with her brother at the palace in Alexandria she bribed a boatman to take her to the Roman general Captivated by her charm the 52-year-old warrior was easily persuaded to help her regain her throne A brief war followed and Ptolemy XII was slain Caesar restored Cleopatra s throne making her youngest brother joint ruler as Ptolemy XIII

Cleopatra bore Caesar a son called by the Alexandrians Caesarion (Little Caesar) Cleopatra followed Caesar to Rome and remained until he was assassinated Soon after Caesar s death Ptolemy XIII was slain perhaps at Cleopatra s instigation and the queen set her son by her side as Ptolemy Caesar

CLEOPATRA APPEARS BEFORE CAESAR

As Caesar sits at his desk in the palace at Alexandria a boatman enters carrying a rolled up rug over his shoulder The rug is flung open and before the astonished gaze of the Roman general stands the young queen, Cleopatra triumphant at the success of her daring trick The painting is by Jean Léon Gerome

After Caesar s death Mark Antony and Octavian had become joint rulers of the Roman Empire Antony sent for Cleopatra to come to him at Tarsus and answer the charge that she had aided his enemies She went not as a penitent but as a proud queen She sailed up the river Cydnus in her barge with her attendants clad in the robes of the goddess Aphrodite Antony was fascinated by her He forgot the charge against her and followed her to Alexandria

A gay winter of extravagant festivities followed At the end of the winter however Antony returned to Rome and to strengthen his alliance with Octavian married Octavian s sister Octavia Meantime Cleopatra had borne him a twin son and daughter Finally tiring of Octavia Antony returned to Alexandria and married Cleopatra according to Egyptian law

Now Octavian fearing that Caesarion would prove a menace to his power persuaded the Senate to make war on Antony In a battle at Actium in 31 B C Antony and Cleopatra were disastrously routed The queen fled to Alexandria with her ships followed by Antony Greeted as he reached the city by the false news that Cleopatra was dead Antony killed himself by thrusting a sword into his breast

For the last time Cleopatra tried her powers of fascination in a vain attempt to charm Octavian Then learning that he intended to lead her in chains in his triumphal procession through the streets of Rome she killed herself—tradition says by the sting of an asp which she ordered brought to her in a basket of figs Caesarion (Ptolemy XIV) was murdered by Octavian a short time after Cleopatra s death

The STORY *of* CLEVELAND'S *Two* ADMINISTRATIONS

CLEVELAND GROVER (1837 1908) My ancestry Mr Cleveland once said was made up of God fearing industrious men and good women who did their duty as best they could and this is all I know or care to know about them since there could be no better origin than such as these

Born at Caldwell N J Stephen Grover Cleveland was the fifth of nine children of a Presbyterian minister His father s salary rarely exceeded $600 a year When young Grover was four years of age (he dropped the name Stephen when a boy) the family removed to Fayetteville N Y and subsequently to Clinton in the same state. He was reared in a home where the atmosphere was kindly and Christian and all the children received a fair education

When Cleveland was just ready to enter Hamilton College his father died and it became necessary for the young man to seek employment to help support the family He borrowed $25 from a neighbor and started out to seek his fortune in the West But he got no farther than Buffalo for there an uncle persuaded him to remain procuring for him a position as clerk in a law office

He studied law with the same diligence and perseverance which marked all his activities and in 1859 was admitted to the bar When the Civil War came and he was unable to enlist because of the necessity of supporting his mother and sisters he borrowed money in order to hire a substitute

Cleveland s political life began with his appoint-

ment as assistant district attorney in 1863. In 1870 he was elected sheriff. While serving in this office he himself sprung the trap which hanged a convicted criminal rather than hand over that unpleasant task to a deputy. "Public office is public trust"—an expression attributed to Cleveland in one of his presidential campaigns—well describes his attitude towards every public position that he ever held.

His public career advanced a stage when, in 1881, he was elected mayor of Buffalo on the Democratic ticket. Good men of both parties looked to Cleveland to bring order out of chaos in the city's affairs, and they were not disappointed. He put the business of the city on a footing of efficiency.

Then, in 1882, Cleveland was elected governor of New York by an overwhelming vote. In this office he pursued the same fearless energetic course which had marked his career in Buffalo. He vetoed so many bills which he regarded as bad that he won for himself the nickname of "the veto governor." Although the baser elements of his party were offended by his policy, he won a large following among the better and more intelligent classes.

Rapid Rise to the Presidency

Cleveland had been elected governor before his term as mayor was finished. Before his term of office as governor had expired he was elected president of the United States. Nominated in 1884 by the Democrats, with Thomas A. Hendricks of Indiana as canditate for vice-president, Cleveland's Republican opponent was James G. Blaine, one of the most brilliant and popular leaders of that triumphant party. A bitter campaign followed, in which the personal character of each candidate was viciously assailed. When Cleveland's campaign managers asked him how they should make answer to a minor scandal which had been dragged out of his past, he answered, "Tell the truth." The vote was exceedingly close, but through the support of independent voters (called "Mugwumps"), Cleveland won.

Cleveland's first term as president (1885–1889) was marked by the same notable independence which he had displayed as mayor and as governor. From the first he showed a disposition to take the entire responsibility for the administration on his own shoulders. He defied the Senate's demand for certain documents, declaring that the president was not subject to its orders in such matters. He used the veto with such frequency that he became known as "the veto president." It is said that he vetoed more bills than all the presidents who had preceded him put together. Most of these were private pension measures which, after personal investigation, Cleveland decided were not founded on merit.

On the question of the application of the Civil Service Law (passed in 1882) President Cleveland found himself between two fires. His "Mugwump" supporters were advocates of civil service reform, but on the other hand the Democrats were hungry for the spoils of office after their 24 years' exclusion. Cleveland completely satisfied neither section of his followers. He refused to make a wholesale removal of Republican office-holders, yet he did make enough changes to dissatisfy the reformers. History will credit him, however, with materially advancing the cause of civil service reform.

In 1888 Cleveland was a candidate for reëlection, but was defeated by the Republican candidate, Benjamin Harrison. This result was in part caused by the revolt of certain elements of his own party and the lukewarmness of the "Mugwumps"; it was chiefly due, however, to the bitter opposition of the manufacturing interests to Cleveland's tariff policy (*see below*). Following his defeat Cleveland retired to New York City, and for the next four years quietly practiced law. In 1892 he was again nominated over the opposition of the Democratic leaders of his own state. This time he triumphantly defeated President Harrison by a vote in the electoral college of 277 against 145.

This surprising result was chiefly due to the tariff question. On principle Cleveland disbelieved in a protective tariff. The growth of a large surplus in the United States treasury showed, moreover, that the tariff rates at that time were higher than was needed to provide revenue for the government. Cleveland believed that such a surplus could only lead to reckless extravagance in national expenditures. Accordingly he had urged tariff reduction, and in 1887 had broken all precedents by devoting to this subject his entire annual message to Congress. A revenue tariff, called the Mills bill, had then passed the House, but it was so amended by the Senate that the House refused to accept it. The tariff thus became the leading issue in the election of 1888, and the main cause of Cleveland's defeat. Since then the Republicans had used their victory to further increase tariff rates in the McKinley tariff of 1890.

Difficulties of his Second Administration

Cleveland's second election to the presidency, in 1892, with Adlai E. Stevenson of Illinois as vice-president, clearly showed that the country disapproved of the Republican tariff policy. Nevertheless in his second administration Cleveland was little more successful in securing from a Democratic Senate a "tariff for revenue only" than he had been in his first term from a Republican Senate. Indeed, he was so dissatisfied with the Wilson-Gorman bill, as it was finally passed, that he styled it an example of "party perfidy and dishonor," and allowed it to become a law without his signature. The next year the Supreme Court still further increased popular discontent by declaring the income-tax provision unconstitutional.

Altogether Cleveland's second administration (1893–1897) was a stormy one. Almost at its beginning, speculation, extravagance, the prospect of a change in the tariff, and uncertainty as to the currency combined to produce the Panic of 1893. Scores of banks failed, and hundreds of firms became bankrupt; factories were closed, thousands of workmen were discharged, hard times came, and labor difficulties arose.

The chief cause of the trouble was the Silver or *Currency question* By 1893 the market value of silver had fallen so greatly through increased production that a silver dollar was actually worth in gold only 56 cents President Cleveland sought to remedy the situation by practically abandoning the double standard of money (bimetallism) and placing the country on the single or gold standard To this end he forced Congress to repeal a law which required the Treasury to purchase a certain quantity of silver each month He also induced it to authorize the sale of bonds for additional gold so that the Treasury would always be able to give gold in exchange for the silver and paper currency which remained in circulation These measures were sound and statesmanlike but they were bitterly opposed by radical members of his own party who sympathized with the free silver principles of the Populists or People s party which was then strong in the West

GROVER CLEVELAND

Labor Troubles and Important Legislation

Serious labor difficulties also occurred in both of Cleveland s administrations In 1886 a memorable riot took place in Haymarket Square Chicago in which bombs thrown by anarchists instantly killed seven policemen and wounded sixty more Following the panic of 1893 discontent was widespread and strikes and riots increased in number and violence As the result of a strike by employees of the Pullman Company in 1894 railways were tied up all over the country property was wrecked or burned and many men were injured and killed Order was finally restored only when Cleveland with his customary directness and courage sent troops to Chicago to protect the mails and federal property

CLEVELAND S ADMINISTRATIONS

1885 1889

Civil Service Reform Aided
Many Private Pensions Bills Vetoed
Haymarket Riot in Chicago (1886)
Interstate Commerce Act Establishes Government Regulation of Railroads (1887)
Anti-Polygamy Law against Mormons Passed (1887)
New Chinese Exclusion Act (1888)
Tariff for Revenue Only Defeated (1888)
Agricultural Bureau becomes Department of Agriculture (1889)

1893 1897

Hawaiian Annexation Treaty Withdrawn (1893)
Panic of 1893
Silver Purchase Act Repealed and Gold Standard Supported
Chicago World s Fair (1893)
Great Railroad Strike Put Down (1894)
Controversy with Great Britain over Venezuela (1895)

Important legislation in Cleveland s administration included the creation of a Department of Agriculture from the old Agricultural Bureau and an Interstate Commerce Commission to regulate railroads and other common carriers in interstate business A new Chinese Exclusion Act and a law barring importation of laborers under contract were also passed

During Harrison s administration a revolution had occurred in the Hawaiian Islands against the rule of the native queen Liliuokalani When Cleveland became president the second time a treaty of annexation to the United States was before the Senate Cleveland withdrew this treaty and prevented annexation at that time because he found that the success of the revolution was largely due to support improperly given to it by the American diplomatic agent in Honolulu In the Canadian fisheries dispute with Great Britain Cleveland vigorously asserted American rights He also threw the protection of the Monroe Doctrine about Venezuela when Great Britain sought to force the South American republic to admit boundary claims which to many seemed unjust For a time war seemed imminent but in the end Great Britain consented to arbitrate The award was mostly favorable to Great Britain but Cleveland s action at this grave time is now considered a great service to the nation

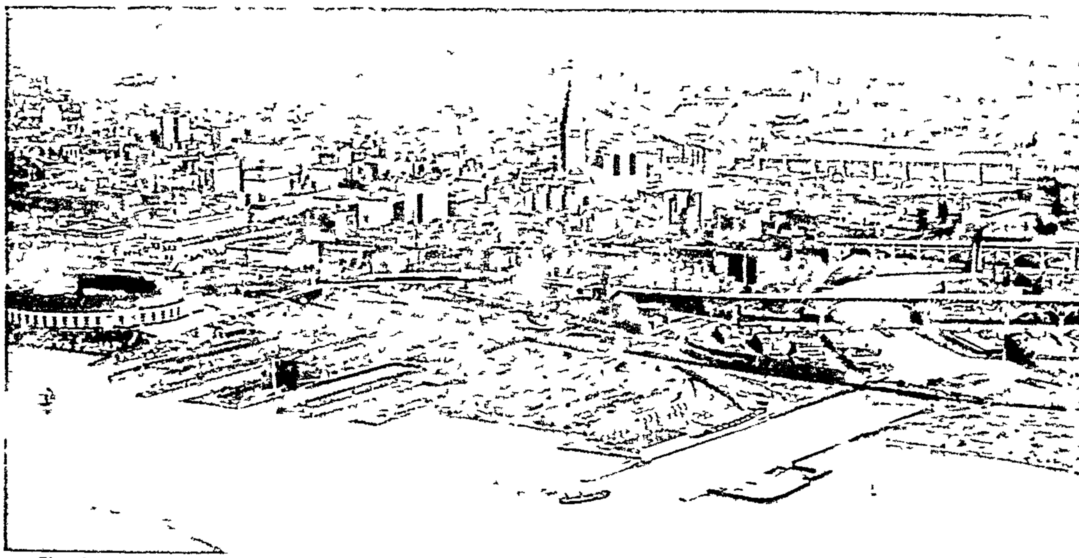
In Retirement

After he left the presidency Cleveland resided at Princeton N J Here with his children and wife (he had married Frances Folsom during his first term) he lived until his death in 1908 He was buried in a beautiful memorial tower erected in his honor at Princeton University

During retirement he served as university lecturer and trustee He took an interest in students and helped many poor boys through college He was fond of children and enjoyed doing things for them His favorite recreation was fishing

Slow in forming a judgment steadfast in holding it he steered his course with a farseeing eye and a steady hand His career emphasized the truth of his remark, I have tried so hard to do right '

CLEVELAND, GIANT *of* INDUSTRY *and* TRADE



Cleveland's broad expanse along Lake Erie presents an impressive view from the air. In the foreground are port facilities for lake steamers. Other docks lie along the Cuyahoga River at the right. From the heart of the downtown district rises the lofty Terminal Tower, Cleveland's tallest building. In the right background is the High Level Bridge across the Cuyahoga River Valley, flanked by much of Cleveland's industry. At the left are the Mall and the Public Square.

CLEVELAND, OHIO. The seventh city in size in the United States and the fifth in manufacturing owes its growth to its location and varied industries. On the south shore of Lake Erie, Cleveland is well situated for trade and manufacturing. It stands between the rich coal fields of Ohio, West Virginia, and Pennsylvania and the iron mines of the Lake Superior region. This advantageous site helps make Cleveland the world's largest ore market and a leading steelmaking center.

The city proper extends along the lake front for 14 miles, and spreads out like a fan on both sides of the winding Cuyahoga River. The river's mouth forms a good harbor, protected by a breakwater six miles long. Some ten miles of docks extend along the river front. In the river valley are many of Cleveland's mills, factories, warehouses, and oil refineries. A panoramic view of this industrial section can be seen from the High Level Bridge. It spans the Cuyahoga Valley, 96 feet above the river.

Cleveland is served by seven main railroads and by many Great Lakes vessels. These bring in iron ore, coal, petroleum, food, and many other raw materials. They carry away hundreds of different products made in the city. Its diversified industries make more than two billion dollars' worth of goods every year. Leading items are iron and steel and their products, machinery, tools, refined oil, motor vehicle bodies and parts, clothing and textiles, electrical parts, aluminum, paint, varnish, chemicals, plastics, storage batteries, and food products.

Pleasant Streets and Modern Buildings

Cleveland was laid out with streets of unusual width, so well shaded that it was known as "Forest City." The business center radiates from the Public Square, which is dominated by the Terminal Tower group of buildings, built at a cost exceeding $200,000,000. Terminal Tower is 708 feet high, the tallest structure outside New York City. Near the square is a landscaped Mall. Around the Mall are grouped a number of public buildings. These include the City Hall, Board of Education, Public Library, County Courthouse, and Federal Building. The Public Auditorium seats about 12,500 people. On the lake shore is the Municipal Auditorium, seating nearly 80,000.

Cleveland's most famous street is Euclid Avenue. Extending eastward from Public Square, it is now largely given over to business establishments. During the 19th century the city's industrial leaders built their mansions and gardens along this tree-lined street in a section referred to as "Millionaire's Row." Off Euclid, on East 86th Street, is the Play House, noted for its stage productions and its dramatic school. Farther east, Euclid Avenue spreads out to form University Circle, the cultural and educational center of the city. Here are Western Reserve University and University Hospitals; Case Institute of Technology; and Severance Hall, beautiful home of the Cleveland Orchestra. The white Georgian marble Cleveland Museum of Art is off the Circle in Wade Park. The School of Art is near by.

Cleveland has one of the finest systems of parks and boulevards in the country. Rockefeller Park contains the famed series of cultural gardens which honor the city's many nationality groups. Cleveland's Metropolitan Park System controls 13,500 acres in a grouping of parks or "reserves" which will some day form a half-circle around Greater Cleveland. This system

serves the city proper and the 23 cities and 45 villages which have developed around it The largest of these are Lakewood Cleveland Heights East Cleveland and Shaker Heights Many of them have lovely residential areas where Cleveland commuters live

Cleveland has an excellent system of public schools and a famous library system one of the finest in the nation The city owns the extensive transit system a small electric light plant a garbage disposal plant and the waterworks An unlimited supply of pure water is brought in from Lake Erie by tunnels and a crib system with intakes four miles from shore Cleveland Airport is one of the largest municipally owned airports in the world covering 1 040 acres The National Air Races are usually held here each September Advanced research in aeronautics is carried on at the airport in the $38 000 000 laboratory of the National Advisory Committee for Aeronautics Another important research center is the General Electric Lighting Research Laboratory at Nela Park

Rapid Growth Since 1827

In 1796 Moses Cleaveland stopped at a small Lake Erie trading post and laid out a town which he named after himself He and his party had been sent by the Connecticut Land Company to survey its territory in the Western Reserve (*see* Connecticut) The real development of the town began in 1827 when the northern section of the Ohio and Erie Canal was completed between Cleveland and Akron This made Cleveland the Lake Erie outlet for the rich mineral and agricultural products of inland Ohio In the 1850 s the city s growth was again speeded by the coming of railroads which helped increase trade and manufacturing

Cleveland was incorporated as a city in 1836 an event celebrated by the Great Lakes Exposition in 1936–37 The city manager-council form of government was started in 1924 and abandoned in 1931 The old system of a mayor and council was restored

Among the city s noted men have been President Garfield John Hay McKinley s secretary of state Marcus A Hanna political leader John D Rockefeller founder of Cleveland s great petroleum refineries Tom L Johnson a progressive mayor who worked for city ownership of utilities and Newton D Baker secretary of war during the first World War Population (1950 census) 914 808

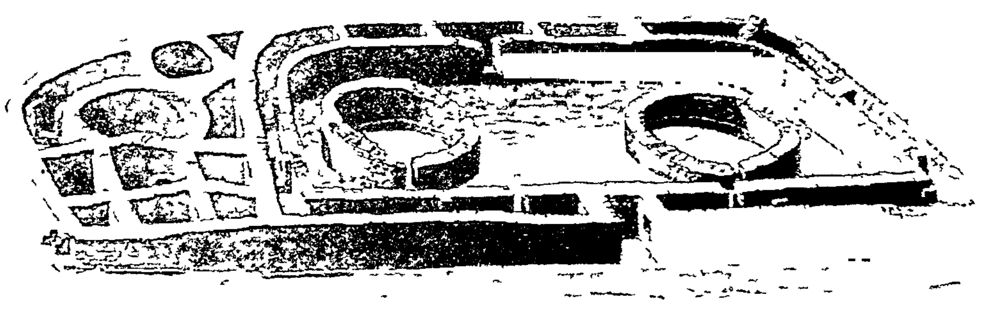
CLIFF DWELLERS In the canyons and cliffs of Arizona New Mexico and southern Colorado and Utah stand the ruins of apartment houses built centuries ago The builders popularly called Cliff Dwellers were ancestors of the modern Pueblo Indians

They raised crops and irrigated the dry soil They made beautiful pottery and turquoise set ornaments They wove cotton fabrics feather cloth and baskets They made *metates* for grinding corn and other stone implements But farmers may not be good at

A COMMUNITY HOUSE ONCE INHABITED BY THE CLIFF DWELLERS

Spruce Tree House in Mesa Verde National Park Colorado probably housed 300 people in its 114 rooms The round structures are the remains of *kivas* or ceremonial chambers A study of the tree rings in the roof beams shows that this house was built between A D 1230 and 1274 Other dwellings in the park area date back to 1066 Some were occupied for 200 years A 24 year drought that began in 1276 may have caused the people to abandon this region for one better supplied with water

CLIFF DWELLERS' TEMPLE OF THE SUN



In Mesa Verde National Park are many cliff dwellings placed in recesses in the canyon walls. On the tableland overlooking one of these structures there were discovered in 1915 the ruins of a building which is thought to be a Sun Temple. The picture shows a restoration of the temple.

fighting; so they became the prey of the more warlike savages about them. To protect themselves and their stores of food, they built these fortress-homes high up in the rock walls bordering the scanty streams.

In some places the Cliff Dwellers dug niches in the soft stone to form the rear rooms and used an overhanging rock as a ready-made roof; more often, they built their houses on a ledge fitting them against the flat sides of cliffs. They made the walls of carefully selected flat stones, laid in adobe mortar, and sometimes they plastered the entire wall inside and out with the same material. The only means of approach to many of these primitive fortresses were wooden ladders or hand and toe holds pecked in the cliffs. In the fertile canyon bottoms the Cliff Dwellers planted corn, beans, and squash with digging sticks and built check dams to catch water for their fields.

Archeologists who have studied the ruins say the prehistoric Anasazi culture of the Southwest reached its peak in the era of the Cliff Dwellers. Among the most famous cliff ruins are those in Mesa Verde Park in southwestern Colorado; in the De Chelly, Del Muerto, and Monument canyons and in the Navajo National Monument north of the Hopi pueblos in northeastern Arizona; and along the San Juan River in Utah. Similar ruins exist on Beaver Creek of the Verde River in southern Arizona, and in the western Sierra Madre Mountains of Mexico.

CLIMATE—*A Molder of* LIFE *and* CUSTOMS

CLIMATE. By far the most important external influence upon life on the earth's surface is climate. It is the dominating factor in determining the animal and plant life of every region. In large measure, it determines where men live and how they get their food, clothing, and shelter. In short, it has controlled in the past and continues to control to a very great extent the development of our entire civilization.

No wonder, then, that the first thing we do when we begin to study a country and its people is to find out the kind of climate they have. But before we can understand the climate in a single region, we must know something about the elements that make up climate in general. (*See also* Weather.)

The Sun and Climate

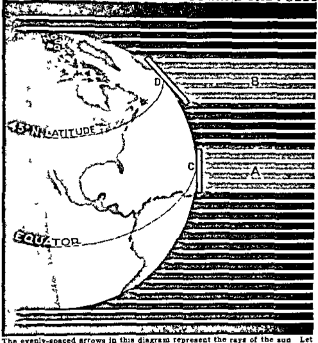
All the factors that enter into climate come from the sun's heat, modified by the motions of the earth. This heat acts in four ways. First, it warms the land, the water, and the atmosphere. Second, it draws moisture into the atmosphere from the waters of the earth, and thus makes rainfall possible. Third, by heating the atmosphere it causes differences in air pressure, and these differences give rise to winds that carry heat or cold, moisture or dryness, to many regions which otherwise would have different climates. Fourth, the sun's heat and the winds together produce ocean currents, some of them warm streams that bring heat to cold regions and some that carry cooling waters into warm regions.

Because the surface of the earth is curved, the direct heating effect of the sun is greatest at the Equator and least at the poles. The diagram on the next page shows how the sun's rays strike the earth at right angles at the Equator, while in a temperate zone they strike the earth obliquely, or slantingly. Because of this slant, a given area in a temperate zone receives fewer rays than the same area would receive in the tropics. This means that it receives less heat. The word "climate" itself gets its meaning from this fact. The ancient Greeks coined it from their word *klinein*, meaning "to incline," because they had correctly observed that an important cause of differences in climate was the different inclination or slant of the sun's rays at different regions of the earth.

Not only do slanting rays scatter their heat over a larger area of the earth's surface, but also they lose more of their heat in passing through the atmosphere. A ray that reaches the earth at the 45th parallel, for example, must pass through about 20 per cent more air, because of its slant, than one which strikes the earth at the Equator. Air absorbs heat so the more air the rays pass through, the less heat reaches the earth's surface. Furthermore, as the slanting rays strike atmosphere, water, or earth more of their heat is reflected away into outer space.

The factors just described control the *yearly average* of heat energy received at any one place. But the angle or slant of the sun's rays at any point on the earth's surface varies 47° between mid-summer and mid-winter, because of the tilt of the earth on its axis as it revolves about the sun (*see* Earth). The amount of solar energy (*insolation*) received by any region depends, then, upon the combined effect of distance from the Equator (latitude) and the seasonal factor. This combination gives the region what is called its *solar climate*, or climate as it would be if it were determined by the sun's heat alone. The zones of solar climate are the tropical or equatorial zone, the two temperate zones, and the two polar or frigid zones. The divisions are marked by the Tropics of Cancer and Capricorn, and the Arctic and Antarctic circles.

WHY CLIMATES GROW COLD TOWARD THE POLES



The evenly-spaced arrows in this diagram represent the rays of the sun. Let us suppose that the five arrows marked A and the five arrows marked B are beams of sunlight each five miles wide. As they approach the earth those beams have the same heating power. When A strikes the earth squarely over the Equator, it gives all its heat to an area, C, which is only about 5 miles square. But when beam *B* strikes at *D*, on the 45th parallel, it spreads its heat over an area about 5 miles wide and 7 miles long. Thus heat A is concentrated in 25 square miles, while heat B is spread over 35 square miles. In other words, a square foot of earth at D receives only five sevenths as much heat as a square foot at C. This leaves out of account the greater loss of heat by beam B in its passage through the atmosphere, as the text explains. The earth is *shown here in the position of equinox*, but the general principle governing the heating effect of slanting rays holds good for all seasons.

Many influences, however, modify solar climate to produce the actual *physical climates* which we find around the earth. The most *important of these influences, or controls*, are water, land, and altitude.

How the Oceans Stabilize Climates

The water of the oceans modifies solar climate by virtue of its stabilizing effect upon temperature. When the sun beats down on the oceans, much of the heat energy is consumed in warming the water and evaporating some of it, hence the air temperature over the ocean does not rise as much as it would otherwise. When, for any reason, less heat is received from the sun, moisture condenses from the air, and this process releases heat. The water also gives off heat, and so the air temperature does not fall to any great extent. Hence, ocean or *marine* climates do not change much when the sun shifts its position with the seasons. *The western coast of the United* States enjoys an even climate the year around because the Pacific Ocean prevents any great seasonal changes.

The most striking example of how ocean currents modify solar climate is provided by *the Gulf Stream*. It gives a moderate climate to parts of northwestern Europe which otherwise would have a climate like that of Labrador (*see* Gulf Stream). January temperatures in the British Isles, for example, are about 20° F. higher than they would be if solar climate were the only factor. This warming effect is carried around the north end of Norway and keeps the sea open in winter, and the winds carry the warmth inland over France and Germany. In summer, the effect is reversed, and these lands are spared the fierce heat and dryness which often afflict the interior of the United States.

Changeable Continental Climates

Land can absorb only about six-tenths as much heat as water can. Therefore, when the sun beats down on the land in summer, less heat is absorbed by the rocks and soil and more by the air above them, with the result that the temperature over the land rises. When winter comes, the land does not have so much stored-up heat to give out again as the ocean has, and so the air above it grows colder. Large land areas in the temperate zone therefore have hot summers and cold winters. Such a climate is called *continental*, Russia and the central United States are examples.

These variations of temperature also affect the winds and the moisture supply. The best example is

the *monsoon* climate of Asia, east and south of central Siberia (*see* Winds). The American Gulf states have a combination of monsoon and continental climate.

Finally, the *altitude* of land—that is, its height above sea level—affects its climate; for air grows less dense with altitude, and cannot absorb so much heat as at sea level. If other conditions are equal, a 300-foot increase in altitude lowers the air temperature 1° F. Also, as the temperature drops, the air is less able to hold water vapor. Therefore, if a moist wind is forced upward by a mountain range, the moisture may be squeezed out or precipitated.

In a region with a typical *mountain climate*, the air is cool and dry in summer, yet the direct rays of the sun are more intense than at sea level because there is less absorption of heat by the atmosphere. Winters are usually warmer than in neighboring lowlands, because the cold air flows down into the valleys and the warm air rises. The side of the mountains toward the prevailing winds collects most of the rain; on the other side the mountains often create *rain shadows*, that is, areas in which rain is extremely rare.

Physical Temperature Belts

In order to trace actual, or physical, temperature belts upon the earth, geographers must first decide what limits to use. Usually they use limits within which important plants will grow. One system defines the *tropical* belt as containing all places where the coldest month has an average temperature of at least 68° F. or 20° C. This is the lowest suitable temperature for the date palm. The *subtropical* belts extend to the regions where the average temperature is 68° F. for from four to eleven months a year. The more delicate tropical plants cannot live in this belt.

The *temperate* belts include all localities beyond the subtropics which have an average temperature of 50°F. for one to four months. The belts of *frigid* or *polar* climate cover portions of the earth which do not have an average temperature of 50°F. for even one month. Here cereals will not ripen and trees will not grow. Temperature belts may also be differentiated in terms of latitude. The *low latitudes* extend from 0° (the equator) to about 30° both north and south; the *middle latitudes* from 30° to 60° in both the Northern and the Southern hemispheres; and *high latitudes*, from about the 60° to the poles.

The greatest extremes of temperature ever recorded under standard observing conditions were a heat of 136.4°F. at Azizia in the Libyan Desert, on Sept. 13, 1922, and a cold of 94°F. below zero at Verkhoyansk, Siberia, on Feb. 5 and 7, 1892.

Physical Moisture Belts

The surface of the earth may be divided into moisture belts, which correspond roughly to the belts of planetary winds. This correspondence occurs because both the planetary winds and the moisture conditions have the same causes. The winds arise because differences of temperature create differences in atmospheric pressure; moisture conditions are affected at the same time because air which becomes warm tends to absorb moisture, while air which is cooling tends to precipitate moisture (*see* Rainfall).

Wherever the sun is directly overhead in the equatorial zone, warm moist air is continually forced upward and cooled. Moisture condenses from the cooling air, and rain falls in heavy steaming showers. From each side of the rainy belt the trade winds are flowing in. These winds get warmer as they come and *absorb* moisture; hence any region over which they blow receives little rain.

This whole system of winds shifts with the seasons, so that regions within the equatorial zone, such as the Amazon and Congo river basins, usually have wet seasons when the belt of rising air is moving north or south over them, and drier seasons when the trade winds are blowing over them.

Temperature-Moisture Climate Belts

Beyond the belts of the trade winds are the belts of the horse latitudes (*see* Winds). Here the air is descending and getting warmer. It therefore absorbs moisture; and hence regions lying in the horse latitudes tend to be dry. The Sahara, Arabia, and parts of Mexico are examples.

At the northern and southern edges of these belts, the land comes under the drying influence of the trade winds in summer, but in winter it has the temperate-climate type of weather. Hence, summers tend to be dry and winters moist. Such a climate is called *mediterranean*, because the best known example of it is found around the Mediterranean Sea.

In the belts of the westerly winds, regions may be either moist or dry. If a region gets westerly winds, and cyclonic storms which draw considerable moisture from other quarters, the region will enjoy good rainfall. The eastern United States is an example. If the winds lose their moisture on mountain ranges, as they do along the Pacific Coast of North America, the regions east of the mountains will be semi-arid or even desert, as in the American Southwest.

The polar regions are deserts, both because they receive little heat from the sun, and because they receive very little moisture. Most of the moisture brought from the surrounding seas by the prevailing winds is precipitated as snow by the cold, before the winds can get far inland.

These great differences in moisture supply, ranging from humid or wet to arid or dry, result in characteristic differences in plant life. If it is combined with a warm enough temperature and suitable soil, a humid climate produces a *forest*. When the rainfall is between 20 and 40 inches a year in the middle latitudes, tall grasses are dominant, trees grow only along streams, and the region is called a *prairie*. On a *steppe* the rainfall averages less than 20 inches and the grass is short. In tropical areas where there is a distinct dry season, *savannas* bear tall, coarse grass and, in places, scattered scrubby trees or thorn bushes. In the driest regions, called *deserts*, bunch grass may spring up where one of the rare rains fall, but most of the land is barren. (*See also* Deserts; Grasslands.)

The timeliness of moisture is an *important factor* A few good rains in the growing season can produce grass while tremendous blankets of snow in winter without summer rain may result in nothing but desert The rate of evaporation and the character and slope of the land are also important If the soil does not hold water and run-off is rapid vegetation may be sparse or even lacking in spite of good rains

Beginning with W P Koppen 20th-century geographers have usually divided the land areas of the world into *climate regions* each of which is suited to a certain type of vegetation. Some classifications list more than 30 climate regions A simple classification might list the regions as four main groups with their sub-groups as follows

1 Equatorial—rain forest tropical jungle tropical scrub and desert

2 Subtropical—rain forest dry forest savanna and desert

3 Temperate—deciduous forest evergreen forest or *taiga* prairie or steppe and desert

4 Polar—tundra and polar desert

Advantages of Living in a Temperate Climate

One of the most fruitful results of studying the influence of climate on human society is the link established between temperate climates and the progress of civilization In this respect the great advantage of a temperate climate is that it compels people to work but does not require too much work In polar or hot desert climates the land is so unfruitful and animal life so scarce that people must work very hard all the time to get a bare living In most tropical climates food is naturally so abundant and so little shelter and clothing are required that people tend to remain indolent and unprogressive But in temperate regions people have to work fairly hard to produce what they need from the soil hard enough to develop energetic habits but they have leisure time in which to apply that energy to improving themselves and their environment beyond the strict requirements of a bare living This alone is enough to explain why most of mankind s progress has been made by peoples who lived in temperate climates

Of the different kinds of temperate climate a stormy or changeable one seems to be the most stimulating When Ellsworth Huntington studied factory workers in Pennsylvania and Connecticut he found that they worked better after a storm than during continuous pleasant weather The factory management did not make them work harder they did so because they felt more like working From many such studies Huntington concludes that the best or *optimum climate for the white race* is a moist changeable one with average temperatures of 42° F in winter and 64° F in summer Southeastern New England has such a climate so does much of north western Europe

Changes and Cycles in Climate

We often hear of severe old fashioned winters which suggests that the climate has become much milder in our times The Weather Bureau records reveal no sharp change, but scientists are discovering that small changes do occur in cycles or periods in different parts of the world

In 1890 the Austrian scientist Eduard Bruckner published evidence that climate the world over varies slightly between dry warm and cool wet conditions and back again every 35½ years Recent peaks of the cool wet periods occurred in Europe in 1810 1845 1880 and 1915 The European climate is largely marine in areas of pronounced continental climate the cycles seem to be reversed

Since the heat received from the sun seems to underlie all weather and climate scientists naturally suspect that this heat might undergo periodic changes and thus cause such cycles as Bruckner suggests Intensive studies are being made therefore based upon measurements of the *solar constant* This is the amount of heat that would be received by an area one centimeter square (about 1/6th of a square inch) in one minute if the atmosphere were not present and if the area were held squarely across the sun s rays Tests prove that the heat so received will raise the temperature of one gram of water 1 93° C

In 1933 the Smithsonian Institution announced the possibility that a 23-year cycle may exist it seems to be related to periodic changes in sunspots

Small Heat Changes Have Big Effect

Our knowledge of climatic cycles can grow only slowly for information concerning them is extremely difficult to obtain The solar constant is a small unit and delicate measurements are needed to detect any changes Moreover the insolation of a region differs widely from its solar constant and allowances must be made for these differences Yet these difficulties must be overcome because most cycles it is believed result from changes of less than half a degree centigrade in the average annual temperature As an example of the influence of small changes scientists estimate that lowering the average annual temperature by 5° C would bring on another ice age

There can be no question however that more or less regular changes in climate have occurred in past ages Evidence for shorter cycles ranging from a few years to a few centuries in length is found in annual tree rings in the *varves* or clay layers left by lakes and glaciers every year and in the varying amounts of water in fresh water lakes (*see* Drought) The greatest cycles which run over thousands or scores of thousands of years seem to have caused the succession of ice ages and interglacial periods (*see* Ice Age)

Clive Robert Lord (1725–1774) The real founder of Great Britain s former empire in India was Robert Clive a great soldier and a fine administrator He was born in Shropshire England of a well-to-do county family At school he was idle and unruly When he was 18 years old he went to India as a writer or clerk in the employ of the East India Company His post was at Madras a trade center

CLIVE OF INDIA

The chief founder of Britain's former empire in India was Robert Clive. Beginning as a clerk in the East India Company, he became both a great general and a statesman

on the east coast of southern India. The young man was lonely and bored and spent much time in the governor's library in systematic study, making up for his wasted years at school.

At this period there were many disputed claims to the thrones of the Indian states because of the decline of the once powerful Mogul empire (*see* India). The French and British each wanted rulers that were friendly to them. In 1746 the French took Madras. Clive escaped from the town and joined the East India Company's military forces. Peace was soon made, however, and the young man had to go back to his clerkship. Five years later his great opportunity came. The French and the British were again in arms, and Clive went back to the army with the rank of captain.

With a few hundred soldiers, part Europeans and part Sepoys (Indian troops), Clive marched inland from Madras and took the fort of Arcot. For some weeks he held out against a host of Indians who laid siege to the fort. When his enemies finally withdrew, he followed them and defeated them in battle. In the end the French and their allies were forced to give up and leave the rich coastal district, the Carnatic, to a native ruler (nawab) who favored the English.

After ten years in India, Clive married and returned to England in 1753. There he was elected a member of Parliament. The siege of Arcot had given him a great military reputation, and in 1756 the East India Company recalled him to Madras with the rank of lieutenant colonel Clive had scarcely reached the port when he heard of the outrage known as the Black Hole of Calcutta.

The Black Hole of Calcutta

Calcutta was the rich trade center of Bengal, in northeast India, where the British were established. The Indian rulers of Bengal were friendly to the English until Siraj-ud-daula succeeded his uncle as nawab Siraj-ud-daula captured the old fort of Calcutta and plundered it on June 20, 1756. Many of the English were able to escape in ships. The 146 who remained were imprisoned throughout a stifling hot night in one small room. The next morning only 23 came out alive from the "black hole."

Clive, taking his men by sea, reached Calcutta and routed the Nawab's forces. The next year, at the battle of Plassey (1757) he defeated the enormous army of Siraj-ud-daula, who fled from the field on a camel Clive then entered into secret negotiations that put the Nawab's commander in chief, Mir Jafar, on the throne of Bengal instead of Siraj-ud-daula.

The grateful Mir Jafar took Clive through the rich treasury, filled with rupees, gold and silver plate, and jewels, and begged him, as representative of the East India Company, to take what he wanted. For his personal share Clive took an amount equal to £235,000 and a quitrent, or annuity, from the lands in Bengal amounting to £30,000 a year.

After years of incessant activity, Clive's health gave way. He returned to England in 1760 and was received as a conqueror. He was again elected to Parliament, and in 1762 he was made Baron Clive of Plassey in the Irish peerage as a reward for his service.

In 1765, when affairs in India were very critical Clive returned for the third and last time, with the double title of governor of Bengal and commander in chief of the army. He consolidated the East India Company's rule over Bengal, the Carnatic, and other Indian states, reformed the administration, and reorganized the armed forces. He tried also to end the evils of private trading, which had been carried on by the Company's employees. This effort was not successful and was resented by employees who had reaped rewards much less princely than Clive's own suddenly acquired fortune.

When Clive returned home in 1767, he had to defend in Parliament the wealth he had amassed Against men who were far more corrupt than himself he boldly and frankly defended his acts, and when telling Parliament how Mir Jafar had invited him to take all he wanted, he said: "At this moment I stand astonished at my own moderation." In the end he was vindicated, and Parliament passed a motion declaring that "Robert, Lord Clive, did render great and meritorious service to his country."

The bad effect of the climate of India together with the bitter attacks upon him so affected Clive's health and mind that he committed suicide in 1774 He had a host of admirers as well as many bitter enemies. In India his military successes and leadership were responsible for a remarkable expansion of British influence.

CLOTHING—*One of* OUR GREATEST NEEDS

CLOTHING People need clothing more than they need anything else except food and shelter. They need it to keep them warm in cold weather and to shield them from the sun in hot weather. They need it as a protection against rain, wind and snow. They need it as a covering to keep their skin from being bruised and cut.

For some kinds of work and play clothes give special protection. Football players, for example, wear padded uniforms and helmets. Firemen in action wear waterproof helmets, coats and boots. Welders wear hoods and goggles as protection against sparks.

Clothing is important for appearance as well as for protection. People in every land and in every kind of civilization adorn themselves with clothing and ornaments. They differ only in their idea of what is suitable and attractive. A native girl in Africa may wear little clothing to "dress up," but she puts on many strings of beads, wide armlets and earrings so big they pull her ears out of shape. An American girl wears a party dress and simple jewelry to a dance. But both girls feel well dressed.

Clothing has other important uses. Some kinds, like the policeman's uniform, call attention to the wearer's occupation. Clothing combined with insignia may show the wearer's rank, as it does in the army and navy. Costumes may have religious meaning both among civilized and among primitive people.

People Need Many Kinds of Clothes

The pictures on this page show some of the reasons why people need many kinds of clothes. Those who live in a climate where the weather changes with the seasons need more variety than those who live where the weather is always warm or always cold.

People who live in an industrial country usually have more clothes than those who live in a land with


1 SUN


2 SNOW


3 RAIN

DRESSING FOR DIFFERENT ACTIVITIES AND FOR THE WEATHER


4 SCHOOL


5 PLAY


6 WORK


7 PARTIES

These pictures show why people need many kinds of clothing. 1 On the beach they want the sun to tan their skin. 2 In winter they need protection against cold and snow. 3 In the rain they cover their other clothes with waterproof garments. 4 Clothes for school are simple. 5 For play and sports clothes allow plenty of freedom for running and swinging of arms. 6 Work clothes must be sturdy and strong. 7 Party clothes are designed to make people look attractive.

DRESSING FOR HOT AND COLD CLIMATES

1 The clothing of the Arab shown above protects him from the hot sun and wind-blown sand of the desert 2 This African boy is wearing little more than his beads. But he is comfortable in the hot land where he lives 3 Furs and leather boots keep the Eskimos warm during their cold Arctic winters

few factories. Clothing is cheaper and more plentiful in the manufacturing countries. Styles change from year to year, and people often buy new clothes before their old ones wear out. They become used to having special clothes for different occupations and occasions. An American boy may have several outfits for school, a uniform for baseball or the school band, camp clothes, and work clothes, as well as a best suit. A boy in Greece, a country with few factories, may feel well off if he has two outfits, one for every day wear and one for special occasions.

Weather, Climate, and Clothes

Warm-weather clothes are made of porous, lightweight material. They may be looser, shorter in the sleeves, and more open at the neck than winter garments. They are designed to let air reach the skin, because air cools the body by evaporating perspiration. In cold weather, people put on more layers of clothes, with a topcoat of closely woven cloth, fur, or leather for outdoor wear. The coat keeps out the cold air and the warmth of the body is held between the layers of clothes. Aside from these differences, summer and winter clothes are much alike in temperate climates.

But in hot and cold lands, climate may set the style. The African boy pictured above wears almost no clothing. Climate and custom have made his scanty costume proper and fashionable. His skin is dark and does not need much protection from sun. He is cool because air is in constant contact with his skin.

The Arab in the same picture illustrates another style set by climate. He is well bundled up, though the daytime heat in his country may be intense. He needs the protection of clothing against the fierce sun and wind-driven sands of the desert. He needs it, too, against the bitter cold of desert nights.

The Eskimo shows how an Arctic climate can set a style of dress This little girl is wearing a typical winter outfit of the Eskimos. Her fur hood, fur coat and mittens, and sealskin boots keep out the cold air and hold in the heat generated by her body

What Is Clothing Made Of?

Since clothing has to serve many purposes, it must be made of many materials. The pictures on the next page show important sources of these

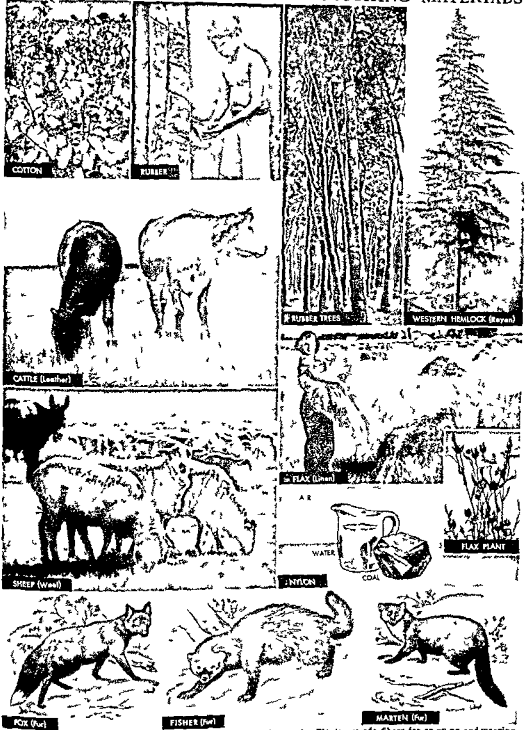
Cloth is the favorite material for most garments. It is soft and flexible and conforms to the shape of the body. It can be thin or thick, light in weight or heavy. It can be dyed in a variety of colors. It can be made for beauty or for durability.

Hairlike *fibers* are the raw materials of cloth *Spinning* fibers (drawing them out and twisting them) produces yarn or thread. *Weaving* or *knitting* yarn produces cloth. Thread is used for sewing the cloth into garments. The fuzzy white part of the cotton plant (the boll) is a mass of fibers So

DUTCH DRESS IN HOLLAND, MICH.

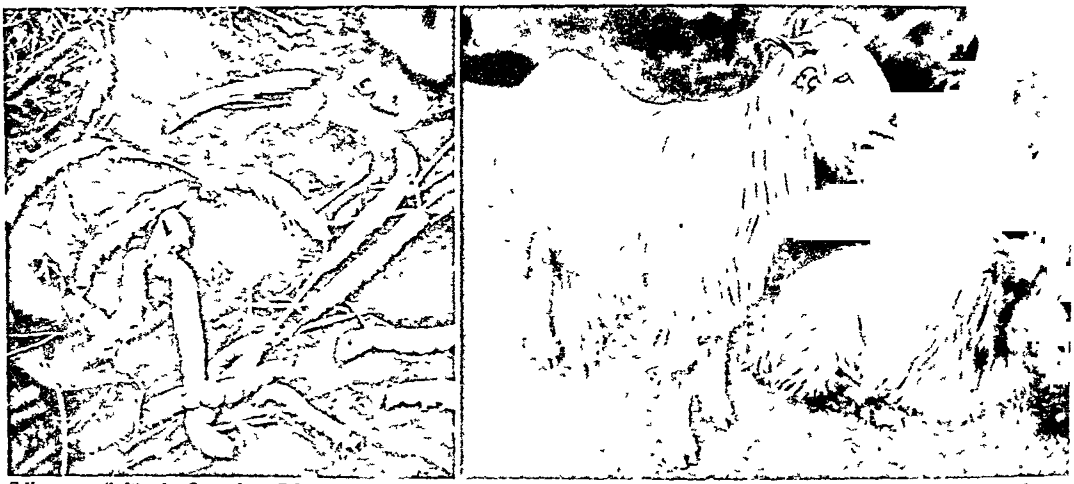
Styles in dress are much alike in Europe and America. But for festivals many people like to wear the styles of their ancestors. The people of Holland, Mich, wear the old Dutch costumes for their tulip festival every spring.

ANIMALS AND PLANTS PROVIDE CLOTHING MATERIALS



Raw materials for clothing come from many different plants and animals Plants provide fibers for spinning and weaving and sheep supply wool The hides of cattle and sheep are used for leather Furs are the skins of many kinds of animals. Air water coal and wood are used to make synthetic fibers such as nylon and rayon

THESE ANIMALS PROVIDE COSTLY CLOTHING MATERIALS



Silkworms (left), chiefly in far-off Japan, supply our silk, spinning the fine lustrous filaments around themselves to make their cocoons. Unreeling the filaments and twisting them into silk yarn for weaving requires careful handwork. Silk, therefore, is an expensive fabric. Some of our finest wool comes from Cashmere goats, like those shown above (right). These goats are native to Kashmir (formerly Cashmere), India. They are rare, and so wool from their soft coats is expensive.

is the woolly coat of the sheep. The long woody stem of the flax plant contains the fibers that make linen yarn and thread.

Rayon and nylon are *synthetic* fibers, that is, they do not occur naturally but are made by man. The source of rayon is wood pulp or cotton linters. Most of the wood is western hemlock but some is southern pine. Nylon is made by a long series of chemical processes from coal, air, and water.

Luxurious Cloth from Rarer Fibers

Silk cloth is strong and beautiful. The fiber is a long lustrous *filament* which the silkworm spins around himself to make his cocoon. Farmers who raise silkworms have to give them a great deal of careful attention so that they will be healthy and spin strong filaments. Workers unwind the filaments and twist them into thread and yarn. This is a long, tiresome process. Since producing silk yarn requires so much work, silk cloth is expensive.

Not all wool comes from sheep. A type called mohair comes from angora goats. Cashmere goats provide a fine soft wool. Unusually warm, strong wool comes from llamas, alpacas, and vicuñas—animals that resemble goats.

Clothes from Leather, Rubber, and Fur

For some kinds of clothing, cloth is not so good as other materials. Leather is best for shoes. It can stand hard wear and is comfortable. It is also good for gloves, windproof coats, and belts. The raw materials of leather are the skins of cattle and other animals. They are treated by a chemical process called *tanning* to become strong and pliable.

Rubber is used for waterproof garments. The source of rubber is a milky liquid known as *latex*. This liquid flows from rubber trees when the bark is cut. Workers gather latex and ship it to rubber factories. There it is converted into the material we recognize as rubber. There are also rubber substitutes, made entirely of chemicals. Both natural rubber and the substitutes go into rubbers, galoshes, raincoats, garters, and rubber soles and heels for shoes.

The animals pictured on the preceding page as sources of fur provide costly coats and fur pieces. Fishers and martens are rare today, but fur farmers raise many foxes. Other animals which provide furs include rabbits, muskrats, minks, beavers, sheep, raccoons, and opossums. (Pictures of these animals appear in articles on the individual animals.)

Hats for Protection and Ornament

The leading materials for hats are felt for winter and straw for summer. Felt is a kind of fabric made of wool, cotton, or fur fibers matted together. Straw is fiber from the stalks and leaves of various plants. Workers braid straw fibers and then sew the braid into hat shapes. Or they weave the fibers into hat shapes. Some hats which look like straw are made of synthetic fibers.

Men and boys wear hats chiefly for protection. Girls and women like hats for their appearance as well. They use straw, felt, and many other materials and a great variety of ornaments.

Many Workers Produce Our Clothing

MAKING clothes is a long series of different kinds of work that begins on farms and ranches, in forests and mines. Everything we wear originates in the world of nature. Workers raise crops or take natural products from their environment. They ship them to other workers. The second group carries out the next step in making the products into clothes and in turn ships them to other workers. At the end of the chain of workers and processes, the clothes appear in retail stores, ready to be bought and worn.

The farmer is the most important of the people who raise materials for clothes. He tills the soil

to produce plant crops and tends animals for their products He may work alone or have other people help him as hired hands

Not all the farmer's helpers are people. Horses are still important farm and ranch workers in some places Dogs are important helpers to people who raise sheep, especially if their flocks are large An old saying declares, "There is never a good flock without a good shepherd, and never a good shepherd without a good sheep dog" Sheep dogs round up, guide, and protect sheep A good dog can handle as many as 1 200 sheep if the land is not too rough

Farmers and ranchers raise cotton wool flax, and silk—all the natural fibers for cloth They raise the cattle whose skins make leather Plantation owners—a kind of farmer—cultivate the rubber trees that yield latex Fur farmers raise many of the animals whose pelts go into fur coats and other furs Some of the trees that supply pulpwood for rayon are cultivated as a farm crop

Some workers obtain natural products for clothing without raising them These workers include fur trappers who catch wild animals lumberjacks who chop down forest trees for pulpwood, and miners who go down into the earth for coal

Chemists invented the synthetic fibers as well as the rubber substitutes That is why a chemist stands next to the farmer on the chart of clothing workers In addition to inventing new materials, chemists create dyes starches and chemicals which make clothing materials look better and wear longer

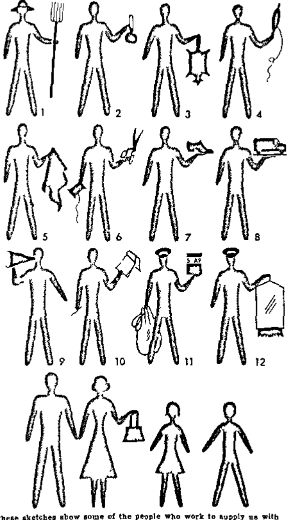
Producing Finished Materials for Clothing

More than a million people in the United States work to make cloth from fibers They are usually called textile workers Some of them clean wool, cotton, flax, and silk fibers and prepare them for spinning Others operate machines that spin fibers into yarn Many workers run looms and knitting machines to weave or knit the yarn into cloth Others dye yarn or cloth to give it color Some operate machines that shrink cloth or add a finish for beauty or durability

In addition to the people who work with the clothing materials there are clerks and stenographers who do the office work necessary to run textile factories There are mechanics to look after the machines Executives do the planning and carry the responsibility

Workers in tanning factories treat animal skins to make them into leather Those in rubber factories make finished rubber from latex or crude rubber, or they manufacture rubber substitutes Workers in fur factories process and dye furs to make them suitable for clothing Every factory has its people who work directly with the clothing materials and, in addition, its office force and executives

DO YOU KNOW THESE CLOTHING-WORKERS?



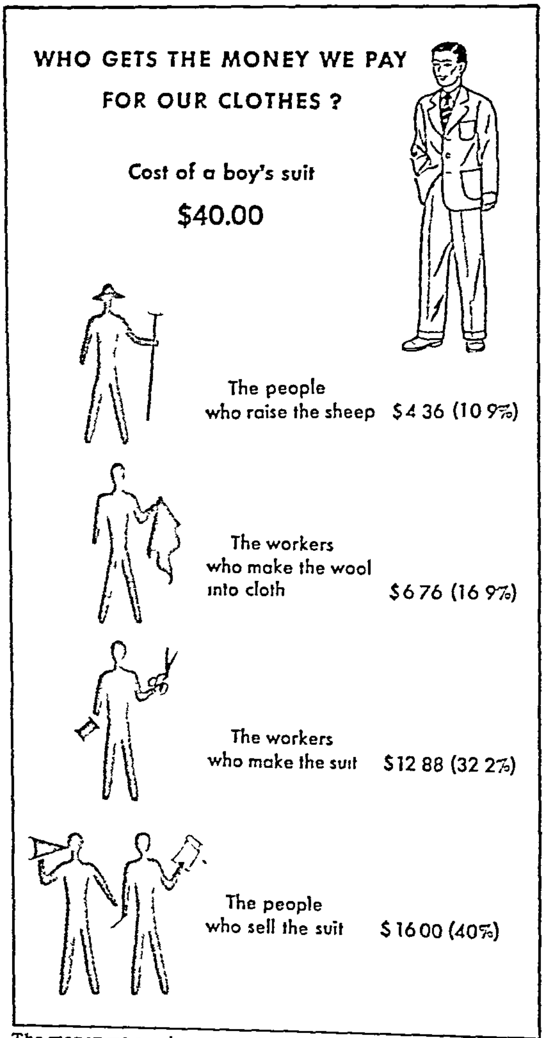
These sketches show some of the people who work to supply us with clothes and to keep them clean 1 Farmer 2 Chemist 3 Fur farmer and trapper 4 Spinner 5 Weaver 6 Garmentmaker 7 Shoemaker 8 Transportation worker 9 Advertiser 10 Salesclerk 11 Laundry worker 12 Dry cleaner The article explains the tasks of these and other clothing workers At the bottom are a mother and father who pay for the clothes and a son and daughter who can help care for them

Each type of processing worker uses products that other workers make Such products include machines, tools chemicals and boxes and paper for wrapping shipments The people who make these products can be called clothing workers too

Over a Million Garmentmakers

After the raw materials have been converted into cloth, leather rubber, and fur workers make these finished materials into clothing

There are almost as many garmentmakers in the United States as there are textile workers Chief among them are the cutters and sewers Cutters use either shears or cutting machines The machines can



The money we pay to a store clerk for a garment actually goes to many people. This chart suggests how it is divided in normal peacetime years. The figures at all levels include costs such as overhead and advertising.

cut through many layers of cloth at once. A skilled operator can cut out garments enough to keep about 75 sewing-machine operators busy.

Other garmentworkers include designers, pattern-makers, pressers, office workers, and executives. In addition, there are shoemakers and hatmakers.

Many Other People Help to Provide Clothes

Clothing could not be made and sold the way it is today without transportation workers. They run the trucks, trains, and ships that carry the raw materials from farms to textile and other factories. They transport the finished materials to garment factories. Finally, they take the finished garments to retail stores.

Advertising accompanies many stages in making clothes. Producers of yarn, textiles, dyes, chemicals, and machinery advertise to others in the industry. Garment factories advertise their products to attract retail buyers. Retail stores advertise their stocks of clothing to attract the public. Writers and artists who create this advertising are important clothing workers.

The clerk who sells clothing in a retail store is the last worker in the chain which began on farm or ranch, in forest or mine. He or she is the only clothing worker most people see. They pay this clerk for their clothes. But the store has bought the clothing from a garment factory. The garment factory bought the cloth from a textile factory, and so on, back to the farm or other source of the raw materials. The price of the clothing includes payment to all the workers in the chain for services and materials.

Payment for clothing usually does not end when a garment is bought. As long as it is worn it must be kept clean and in good repair. Every community has workers who provide cleaning and repair services. Some of them run laundries and dry-cleaning establishments. Others are tailors, dressmakers, shoe repairmen, and hat cleaners.

Where Materials Are Produced and Made into Clothes

THE PEOPLE of the United States raise or make many materials needed for clothes. But they do not raise enough in some cases and have to import the rest from other countries. A few materials are not produced in the United States, and the entire supply is imported.

Farmers in the warm South and West grow enough cotton to supply the country's needs and to sell some abroad. Textile factories, however, import especially fine cotton from Egypt. Ranchers in the grazing states of the West produce most of the wool grown in the United States. In addition, farmers in many parts of the country raise sheep for wool along with other farm crops. But the United States imports about three-fourths of its wool, chiefly from Australia, Argentina, and New Zealand. Only one state—Oregon—grows flax for its fiber, although several other states grow flax for its seed. The United States buys most of its linen from Belgium and Ireland.

The United States leads the world in making rayon and nylon. The largest plants are in Tennessee, Virginia, and North Carolina. These factories are near the source of some of the raw materials (southern pines and cotton linters). They are also close to big knitting mills in the South.

Japan and China, countries where labor is cheap, supply most of the silk used in the United States. Farmers in this country, chiefly in Texas, raise enough goats to supply the demand for mohair. But the other rare wools come from distant lands—cashmere from India, and llama, alpaca, and vicuña wool from South America, mainly Peru.

Clothing Materials Other Than Cloth

Ranchers of Texas and the Rocky Mountain states and farmers of the corn belt raise most of the cattle that supply leather. Other animals whose skins are used for leather include horses, sheep, goats

pigs, snakes, and alligators The United States imports about half the skins it uses for leather

The rubber tree is a plant of the tropics The chief producing areas are in Malaya and Indonesia The chief rubber-manufacturing center of the United States is Akron, Ohio

Since fur makes cold-weather clothing, it would be natural to expect the leading fur-producing state to be a northern one Instead Louisiana leads People in that state trap several million muskrats every year Fur farmers in the North raise foxes and minks Trappers in Alaska and some states catch various kinds of fur bearers The United States also imports many furs

The United States buys most of its straw and straw hats in other countries Panama hats come from Ecuador not Panama Milan straw comes from Italy Mexico and Central America supply cheaper kinds of straw

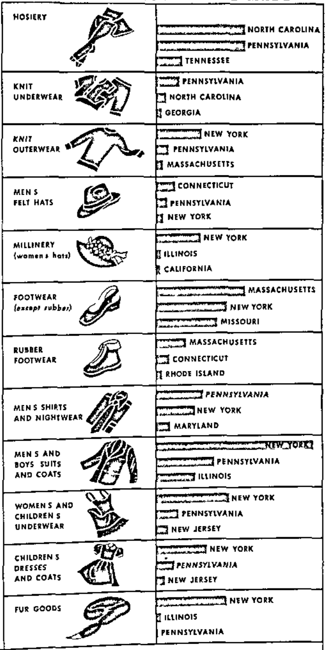
Where Cloth and Clothes Are Made

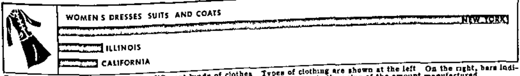
Most factories for making clothing materials are in the Eastern states New Englanders took the lead in colonial times in building small spinning and weaving factories in which the workers used hand methods They kept the lead when power-driven machinery was *introduced into factories* New England had many swift rivers and waterfalls to provide water power Coal was not far away There were plenty of people to work in the factories And rich Yankee traders supplied the money needed to build factories

New England remained the chief area for making textiles until the 20th century Then owners began moving cotton mills south to be near the cotton fields, cheap labor, and cheap electric power Today the South is far ahead of New England in making cotton cloth *New England, however,* still leads in making wool cloth

The chart on this page shows that the East leads in making clothes as well as in making cloth The first clothing factories were established during the Civil War in New York City

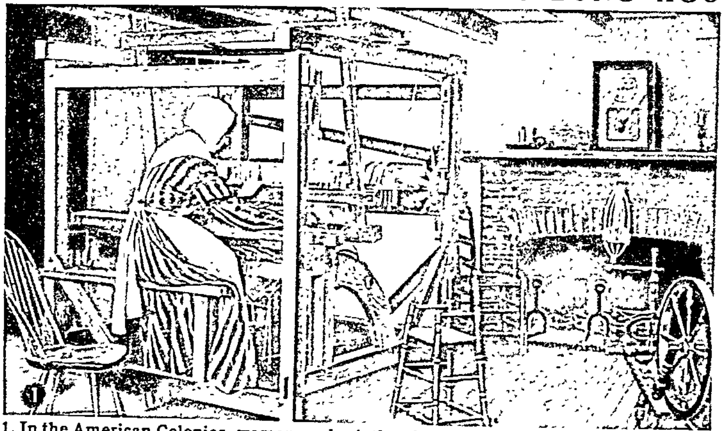
WHERE OUR CLOTHES ARE MADE





This chart shows which states make different kinds of clothes Types of clothing are shown at the left On the right, bars indicate the three states that lead in making each type They also indicate the value of the amount manufactured

GETTING CLOTHING MATERIALS LONG AGO



1. In the American Colonies, women made cloth at home. This picture shows a woman weaving at a hand loom. A spinning wheel stands at the right.

2. After about 1800, peddlers drove through the country, selling dress goods and other articles to housewives on farms and in villages.

Conditions were favorable for the industry to develop there. Immigrants who would work for low wages were pouring into the city. The textile mills of New England were near by. The area was thickly populated, providing a market for clothing.

As the nation grew, people built garment factories in other places. Today almost all the largest cities have clothing factories of some kind. But New York City still dominates the garment industry.

Development of Clothing through the Ages

THE complicated industries that supply us with clothes developed gradually. The first clothing was probably nothing but animal skins scraped and treated to make them clean, soft, and strong. When people learned to spin and weave, they made crude clothing of cloth, using wool or wild flax.

Skill in weaving developed to a high point long before our era. Prehistoric Egyptians made fine linen. Cotton was used in India and silk in China in ancient times to make beautiful fabrics. But only the rich could afford fashionable clothing made of fine materials. The poor wore simple, coarsely woven clothes.

During the Middle Ages clothmaking became a thriving business. Although most clothing was made at home, there were tailors and dressmakers who held fairs at which they sold ready-made clothes to those who

TWO OLD-TIME TAILOR SHOPS

1. During the period of the American Revolution, tailors still sewed by hand. They worked in small shops or at home. 2. A hundred years later, sewing machines were coming into use. This picture shows an early model run by means of a small pedal.

could afford to buy The pooier people either made the r own s mple clothes or else bought the cast-off clothing of the rich from secondhand dealers

Between the Middle Ages and the *Industrial Revolut on* which introduced power-driven machinery there were improvements in *hand methods* These made it possible for more people to have more clotl es But the situation had not changed bas cally when the colonists came to America

Getting Clothes in the Colonies

The first colonists had only the clothes they brought with them from the homeland Friendly Indians taught them how to make fur caps and robes from the skins of wild animals and how to make buckskin gar ments from deer h des

The colonists had brought flaxseed hempseed and sheep with them to the New World (Hemp is a plant with coarse stringlike fibers in its stalk It is no longer used for cloth) They tended their sheep carefully As soon as they had cleared enough land they planted their seed Presently they had crops of flax hemp and wool for sp nning The men built sp nning wheels and looms The women spun wove cloth and made clothes for the entire family

Shoemaking was a household task at first Presently skilled shoemakers came to the colonies from Europe Some set themselves up as traveling shoemakers go ng from home to home in towns and rural areas making shoes to order Others established small shops in villages and towns

It is believed that the colonists built their first textile factory at Rowley Mass about 1638 The early factories were small establishments where skilled craftsmen operated hand looms Soon the colonists could buy small amounts of cloth made of flax wool or hemp raised at home or of cotton imported from the West Ind es

Country people continued to make most of their o n cloth long after the Revolution though peddlers traveled the country roads selling cloth and many other kinds of merchandise People in the growing towns got their clothing in various ways There were

FOUR WAYS OF MAKING CLOTHES TODAY

1 Many g s and women make some of the r clothes at home us ng a sew ng machine run by electric ty like the one shown here. 2 Most clothes are made in fa tor es Th s p cture taken n a fa to y shows many people wo king together to make clothes

3 Above is a dressmak ng shop Such shops make women s clothes to o der Women who a e hard to fit or want ind vidual styles may go to these shops 4 Men s ta lors like the one shown he e make c othes to o der for men.

CARING FOR CLOTHES IS EASY BUT IMPORTANT

1. This girl is putting trees in her shoes before putting them away in a shoe bag. Shoe trees prevent shoes from losing their shape. 2, 3 The boy and girl shown here have learned that two of the best aids to good grooming are the clothesbrush and the coat hanger. 4. This boy's wool gloves will not be damp when he wants to wear them again. Hanging damp gloves up in such a way that the air can get inside allows them to dry thoroughly before the next wearing.

dealers in secondhand clothes and small tailor shops. Some women did their own spinning and weaving, just as their country cousins did. Others bought material at stores and made clothes for their families. Tailors and dressmakers went from home to home sewing for the well to do, boarding with the families for whom they sewed. Wealthy people imported fine fabrics and ready-made clothes from Europe.

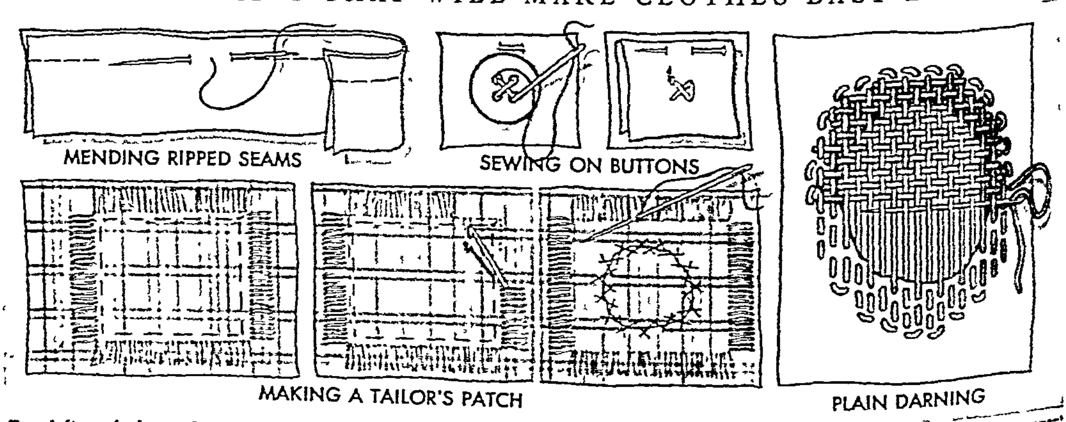
After the American Revolution, machinery began to affect the production of clothing materials (*see* Industrial Revolution). Eli Whitney invented the cotton gin in 1793. This made it easier to clean cotton, and Southerners began to plant cotton instead of tobacco on their big plantations. New Englanders began to build spinning and weaving machines like those in England. They put up factories in which to use them. The first machines were run by water power. Presently steam replaced water power. Late in the 19th century electricity began to replace steam.

The sewing machine was invented at about the time that factory-made clothing materials became plentiful. After establishment of the first garment factories during the Civil War, the business of making clothes in factories grew steadily. Today, although dressmakers and tailors still make clothing, and many people make some of their clothes at home, factories supply most people with all or most of their clothes. (*See also* Garment Industry.)

Taking Care of Clothes

Good clothing deserves good care. A simple but important kind of care is the kind clothing receives when it is taken off and put away until the next wearing. Coats, dresses, trousers, blouses, and skirts keep their shape better if they are hung up on well-shaped clothes hangers when they are taken off. And careful hanging may eliminate unsightly wrinkles and creases before the next wearing.

A FEW REPAIRS THAT WILL MAKE CLOTHES LAST LONGER



Top, left, a rip in machine sewing can be mended by hand. Tie the threads of the machine stitching on the wrong side to prevent further ripping. Then backstitch the ripped part, with the right side up (*see* Sewing). The next two pictures show a good way to replace a torn-off button. A small, doubled-over piece of fabric stitched under the button on the wrong side gives strength. Bottom, left, to make a tailor's patch, first fringe a piece of material larger than the hole and baste it in place. Second, with a fine crochet hook pull the fringe through to the wrong side. Third, secure the fringe on the wrong side with invisible stitches and catch stitch the edge of the hole to the patch. Right, a good darn begins well back from the hole.

Brushing wool garments removes hair dandruff and l nt If garments are brusl ed before they are put away they will be fresh for the next wearing Then a last m nute rush to get dressed will not mean an unt dy appearance

Frequent laundering and dry cleaning of clothes are necessary to an attractive appearance They also *lengthen the life of clothing D rt allowed to rema n in fabric tends to shorten its life*

Care of clothing includes care of shoes Use of shoe trees especially when shoes are damp prevents loss of shape Cleaning and polishing shoes keeps them looking well and n akes them last longer Clean ng and pol shing shoes help them to remain comfortable too by soften ng the leather

Can Mending Be Fun?

Mending can be fun—to girls who like to sew But to most people it is a chore worth doing only because of the results achieved

Small jobs like sewing up ripped seams and replac ing buttons are worth do ng on any wearable garment Major repa rs require more considerat on A tear in a wool skirt for example can be neatly mended with a ta lor s patch as illustrated on the opposite page Such a patch requires skill and patience One must be sure the skirt is worth the work involved

REFERENCE OUTLINE FOR STUDY OF CLOTHING

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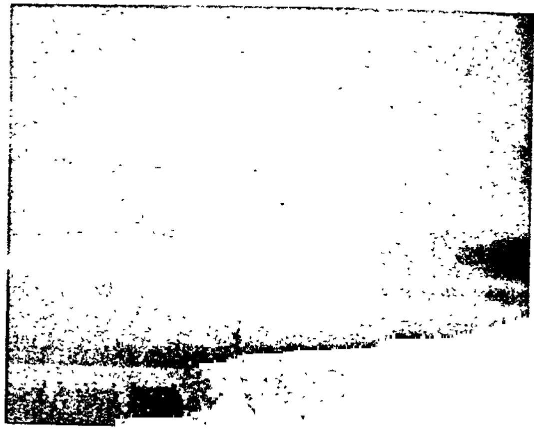
(See also b bliography for Home Econom cs and Manage ment Industr al Revolution)

COMMON CLOUDS AND WHAT THEY TELL

CIRRUS

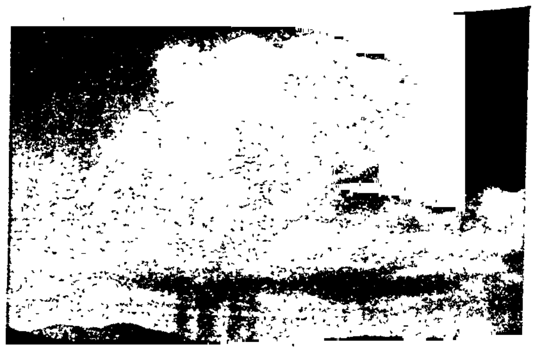


CIRROSTRATUS, with halo

ALTOCUMULUS

STRATUS

CUMULUS



CUMULONIMBUS

Cirrus and cirrostratus often warn of storms a day or two ahead, while altocumulus and stratus may immediately precede bad weather. A fair-weather cumulus cloud sometimes turns to an anvil-shaped cumulonimbus, trailing streamers of rain.

Clouds White clouds drifting in a blue summer sky call to nearly everyone's imagination When you watch them a moment or two they seem to take on familiar shapes such as the images of men or animals This fantasy has entertained people of all times Even Shakespeare remarked it In one scene from *Hamlet* the young prince of Denmark muses Do you see yonder cloud that's almost in shape of a camel?

For ages also men have gazed at the clouds with more serious interest For the ever-changing clouds in the sky tell us a "weather story" Most of us can read some of it We know that small white woolly clouds in a blue sky promise fine weather When a sky is gray and ugly looking we expect rain or snow We all know what to expect from a thundercloud But we can tell much more, if we know what clouds are and why they look different at different times

First of all, we have clouds because the atmosphere contains water If the water is vaporized we cannot see it and the sky looks blue But the ability to hold vapor depends upon temperature (*see* Evaporation) Hence any chilling of the air may cause some of its water vapor to condense into droplets or even form crystals of snow or ice If a mass of droplets trails along the ground, we call it *fog* if it rides high enough to be seen from below, we call it a *cloud*

A cloud looks white as long as it is thin enough to reflect or diffuse sunlight It becomes gray or black when it becomes dense enough to absorb sunlight But then it can hardly hold more water If the temperature falls a bit, some of the moisture falls as rain or snow

Different Kinds of Clouds

The shapes, heights, and appearances of clouds give us many other hints about the weather The fair-weather" combination of white, woolly clouds in a blue sky occurs when most of the air can hold all its moisture as vapor But here and there, over some lake or river, the sun's rays cause a strong updraft of moisture-laden air. At perhaps 1,500 feet above the ground, some of the moisture is condensed into white cloud, and the updraft may carry the cloud several miles high. Then we see the towering, billowy mass of a *cumulus*, or "wool-pack" cloud If it turns gray or black, it is getting all the water it can hold, and it may become a thundercloud (*see* Storms)

In contrast, some change of atmospheric conditions may form a cloud over a wide area This usually happens at a certain level, as, for example, where cold air cuts under warm moisture laden air (*see* Weather) Therefore the cloud which results usually lies in a rather definite layer, and it is called a *stratus* cloud A storm from a stratus cloud may last a day or more, because usually the cloud is widespread

At levels of 20 000 feet or higher, water usually is formed into ice crystals. These crystals make feathery wisps of clouds, either scattered or grouped in streamers called "horsetails" or in a scalelike pattern called a "mackerel sky" Because of their great height, cirrus clouds show a pink glow before dawn and after sunset They also cause halos around the sun and the moon

Cirrus clouds are usually formed of material obtained from other clouds Streamers of cirrus often can be seen shredding away from the top of a tall cumulus cloud Since they travel on high winds at high levels far ahead of their parent cloud masses, they mean other clouds coming" What weather the other clouds will bring depends upon their character

Scientific Classification of Clouds

To describe clouds scientists use the names already explained either singly or combined and three other terms *fracto-* *nimbo-* or *nimbus*, and *alto-* The term *fracto-* means broken A fractostratus or fractocumulus cloud is a mass torn from either parent type The word *nimbus* formerly meant any cloud which gives rain But this told nothing about the kind of cloud so now scientists speak of *nimbostratus* or *cumulonimbus* clouds The cumulonimbus is the thundercloud

The term *alto-* means high and it is used for middle-level clouds at elevations between 6 000 and 20 000 feet A stratus cloud in this level is called *altostratus* Since ordinary *cumulus clouds may reach from the low to the high* level the term *altocumulus* is used for small masses of cumulus at middle levels Such masses usually occur in patterns often as rolls across the sky or as rippled flaky masses The combination terms *cirrostratus* and *stratocumulus* mean respectively cirrus or cumulus material which is widespread enough to form a layer

Clover The clover plants and the bees help one another to live The clovers furnish tempting sweets for the bees, and in return the bees carry pollen from flower to flower for the clovers Men learned this when they transplanted red clover from Europe to Australia It grew and blossomed, *but no seed formed* Scientists soon found the trouble The red clover's special friend, the bumblebee, had been left behind, and it is this bee, with its long neck that sips the nectar in the deep 'cups' of the red clover blossoms Other bees, not being attracted, did not spread the red clover pollen.

Clovers are wonder workers for the farmer They provide splendid forage for cows, and a field may give two or more cuttings a year, of clover hay Clover also enriches the soil in many ways

The long roots reach deeply into the soil and do not draw only upon the top layer, as do many shallow rooted crops. Some kinds, such as alfalfa, can reach water where other crops or grasses might die Most important of all, clovers are legumes and, like other plants of this type, they shelter nitrogen fixing bacteria on their roots (*see* Nitrogen) *These bacteria* make nitrogenous food from the air for the clover, and, if the clover is plowed into the ground, it leaves this food for other plants Hence planting clover and plowing it under improve a field greatly for later crops

Although sweet clover is not a true clover, like alfalfa, it belongs to the legumes, and it has nectar which attracts bees *It grows on soil where clover* would perish, and its long roots carry nitrogen-fixing bacteria some 20 feet into the ground

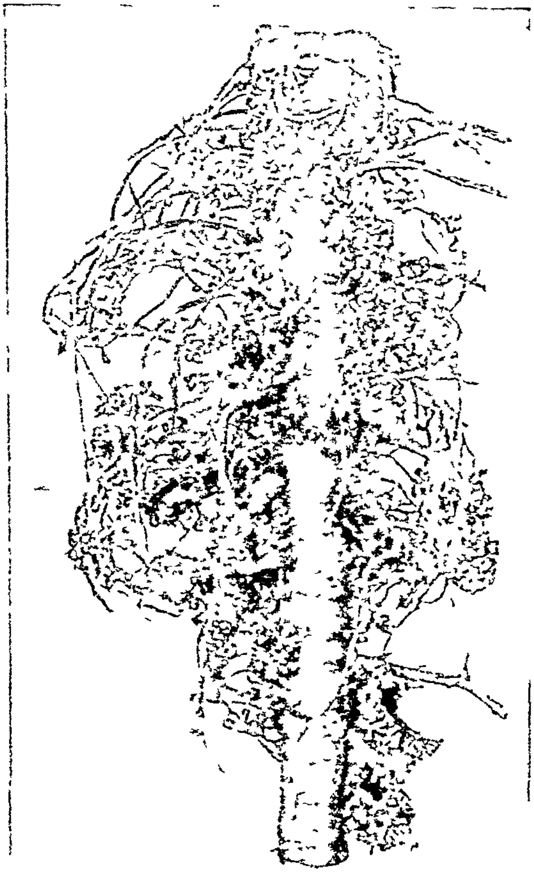
More than 400 species of clover have been listed They grow at their best in the temperate regions of Europe and America The common red clover is one

of the oldest varieties cultivated. The mammoth red clover is an improved variety of the common red. Alsike, or Swedish, clover grows on land too wet for red clover and is a good crop for the honeybees. The white, or Dutch, clover grows in pasture lands and grass plots everywhere. Crimson, or scarlet, clover is used for hay, pasture, and as a cover crop in orchards. Florists also grow the plant. Berseem, an Egyptian clover, has been introduced into the United States to grow in the alkaline soil of the Southwest. Button clover is a valuable winter cover and pasture crop, used in rotation with summer row crops in the South.

An important relative of the true clovers is lespedeza, which is grown as a pasture and hay crop in the southern part of the United States. The principal varieties are Japan clover and Korean lespedeza. Bur clover is a pasture plant related to alfalfa.

The true clovers belong to a genus of the bean family (*Leguminosae*) called *Trifolium* because the leaves are divided into three leaflets. The flowers—red, white, crimson, or yellow—grow in heads or clusters. The sweet clovers have butterfly-shaped blossoms like those of the sweet pea. They may be either white or yellow. The leaves are three-parted. The dried foliage has a pleasant fragrance, and branches of it are sometimes hung in closets. The sweet clovers belong to the genus *Melilotus*. Button clover belongs to the genus *Medicago*.

HOW CLOVER ENRICHES SOIL



In the lumps, called nodules, on clover roots, live colonies of bacteria. These take nitrogen from the air and convert it into nitrates, a natural fertilizer which enriches the soil.

CLOVES. The spice that looks like a nail is the dried, unopened flower bud of the clove tree. The tree is an evergreen related to the myrtle. It grows in the East and West Indies. At first the buds are a pale color, which gradually turns to green and later to a bright red, when they are collected. They dry to a dark brown. Cloves are about half an inch long, with a knob at one end which contains the unopened petals. Their general shape, that of a nail with its head, gave them their name, from the French word *clou*, meaning "nail."

The buds are used as flavorings. Oil of cloves, obtained by distillation in water, is used as a drug, especially as a toothache remedy. It is also used in soaps, perfumes, and ointments. Synthetic vanilla is made from eugenol, an ingredient of clove oil.

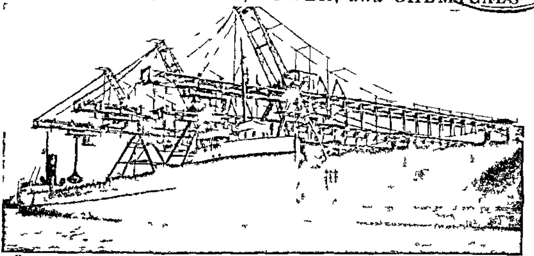
Cloves were an important item in the spice trade of the Middle Ages. They grew originally in a small group of islands called the Moluccas, or Spice Islands. The Dutch cultivated the tree in Amboina, and the French transplanted it to Zanzibar and the neighboring island of Pemba, where three fourths of the world's supply is grown today. Some cloves are also exported from the West Indies. The scientific name of the clove tree is *Eugenia caryophyllata*.

CLOVIS (465–511). One day this king of the early Franks was engaged in a battle with a neighboring tribe of Teutons. His warriors were being driven from the field. The gods Woden and Thor seemed to have failed him. Suddenly Clovis remembered that his wife, Clotilda, had long been urging him to become a Christian. Raising his eyes to heaven, he cried: "Oh, Christ Jesus, I beseech thee for aid! If thou wilt grant me victory over mine enemies, I will believe in thee and be baptized in thy name!"

With this he rallied his men and gained a great victory, and on Christmas Day of the same year (496) the king and 3,000 of his followers were baptized. But Clovis remained at heart the same savage warrior he had been before, and, when the monks told him the story of Christ's crucifixion, he clutched his battle ax and cried: "If I had been there with my Franks I would have revenged His wrongs!"

When Clovis at the age of 16 became king of one tribe of the Franks, these ancestors of the modern French nation were a scattered and disunited people with a number of kings. When he died, 30 years later, he had united all the Franks into a single powerful nation under his own rule. He overthrew the Roman power in Gaul in a battle near Soissons in 486, and before his death he had won for his people a kingdom which reached from the Rhine on the north and east almost to the Pyrenees Mountains on the south. So complete was the Frankish conquest that this land ever since has been called France, from their name.

Mining COAL *for* HEAT, POWER, *and* CHEMICALS



Heavy overhead machinery is lifting out a cargo of coal from a Great Lakes freighter at Duluth Minn In a few hours the boat will be unloaded All summer long these boats bring coal from Lake Erie ports to supply railroads and factories and for winter heating throughout the Northwest Part of the winter supply is left in huge piles like the one behind the ship

COAL One of our most precious minerals is coal Nearly half the energy we use for heat and power comes from it It heats buildings runs trains melts iron ore and makes electricity And coal furnishes thousands of chemical products such as dyes perfumes medicines and synthetic fibers

Coal has two great advantages The cost is low and the supply is almost limitless Some geologists estimate that the United States has enough coal for the next thousand years There will be enough even to supply liquid fuel and lubricants by special processes if the supply of petroleum is ever used up

But the work of getting coal out of the ground remains a difficult and dirty job It is dangerous as well Coal mining machinery has helped make the work easier but men must still go down hundreds of feet below the surface to get the coal There they work in constant danger from cave-ins and explosions Every year more than a thousand men die in coal mine accidents

How Coal Was Made Long Ago

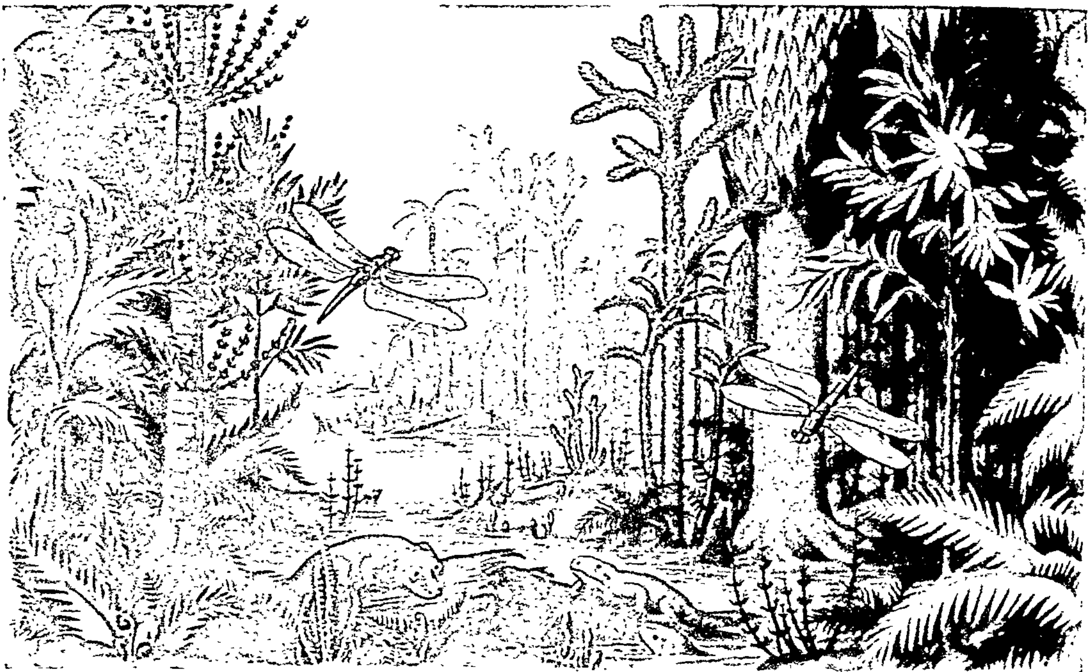
MEN must dig mines to reach coal because as coal formed it was pushed deep under ground The material for it came from plants and coalmaking always started when a forest laid down a thick deposit of dead trees branches and leaves This material was covered with rock and buried for millions of years before it became coal

All this happened many times in many places But one age gave us most of the coal we use today A common name for it is the Coal Age In Europe geologists call it the Carboniferous period American geologists divide the age into two periods the Mississippian and Pennsylvanian Most of the coal in North America began to form in the Pennsylvanian period

The Coal Age was a time of warm moist climate Much of the land was low and swampy From it rose dense forests of strange-looking trees ferns and

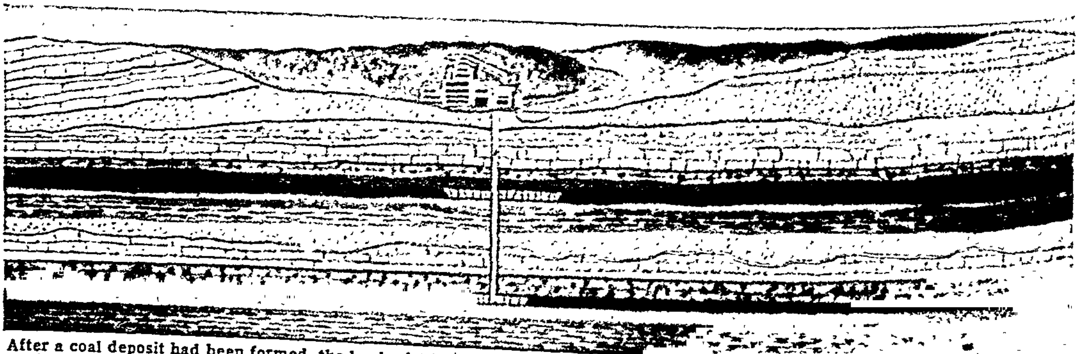
AFTER A DAY S WORK MINING COAL

These miners have done a day s work far below the ground and an elevator cage has brought them to the top of the mine shaft They still wear their safety hats and shoes with reinforced steel tips The tracks are for cars carrying coal



During the Coal Age, strange-looking plants and animals grew in swampy forests. Giant insects buzzed through rushes, ferns, and tall trees. Huge ancestors of modern salamanders hunted for food in the muddy water and rested on half-sunken logs. As the plants died, their remains fell to the bottom of the swamp, making a thick deposit. The picture below shows what happened next to start turning this plant deposit into coal. American geologists call these times the Pennsylvanian period of earth history.

From time to time some of the land started sinking and lowered the dead plant material deep below water. Much of it had rotted away, but plenty of black carbon was left. Meanwhile, rivers washed gravel, sand, and mud from surrounding higher land and laid them in thick beds over the carbon. If the land sank low enough, a shallow sea flowed in and added marine deposits. Gradually the deposits changed to rock, and the tremendous weight of rock pressing upon the carbon helped to change it gradually into coal.



After a coal deposit had been formed, the land might have risen again above sea level and grown a new forest. Then it might have sunk once more, and another deposit of coal would be made. In places such as Pennsylvania, this happened many times. Later the land remained steady and coalmaking stopped. Today the deposits may lie in veins far below the surface, and miners must dig shafts through the overlying rock to reach them. In other places the rock has been worn away and the coal is near the surface.

rushes We know what these plants looked like because they left fossil imprints in the rock layers next to the coal Giant insects buzzed through the air and amphibious animals crept through the bog

As the plant life died it fell beneath the swamp water The pictures show how great layers of mud sand and marine deposits gradually formed over the plant matter and *helped it to turn into coal*

The matter first turned into a spongy *peat* This is a kind of coal-to-be Later the peat turned to *lignite* Lignite is a low grade coal brown in color Finally age-long pressure from the overlying rock produced *bituminous* (soft) coal This is black and is much harder than lignite

The hardest coal is *anthracite* This was formed when the rocks of the region were wrinkled into folds and broken by faults The tremendous pressure and heat from these processes were added to the weight of the overlying rock and hardened the coal deposit

Peat has little fixed carbon lignite holds about 67 per cent Bituminous coal has about 88 per cent and anthracite more than 90 per cent *The quantity of* fixed carbon determines how much heat the coal will give when it is burned

Coal Fields of the United States

Coal is found on every continent but more than a third of the world s supply is in the United States Thirty-six of the 48 states have some coal and it is plentiful in 28 states

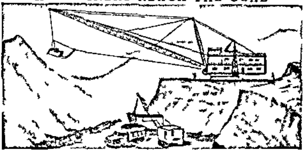
The United States has four great coal fields The Appalachian field lies in parts of Pennsylvania Virginia West Virginia eastern Kentucky Tennessee and Alabama The Illinois field is in central and southern Illinois western Indiana and western Kentucky The Mid Continent field includes deposits from Iowa to Texas The fourth field in Colorado Utah and Wyoming is the least developed Colorado and Washington have important deposits

Most of the coal in these regions is bituminous The largest anthracite field in Pennsylvania covers only 484 square miles Other anthracite fields are in Colorado Washington and Arkansas The leading coal states are Pennsylvania West Virginia Illinois and Kentucky

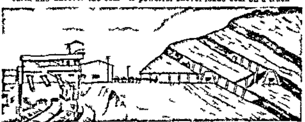
How Men Take Coal from the Earth

COAL lies at various depths below the earth s surface The seams may run fairly level or they may be highly convoluted The pictures on this page show various coal deposits and how the miners reach them to dig the coal

HOW MINERS REACH THE COAL

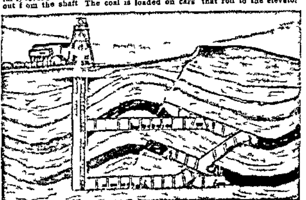


When coal lies close to the surface miners use *open-cut* or *strip* mining methods Here a huge machine works a scoop on a dragline to strip away earth and uncover the coal A powerful shovel loads coal on a truck



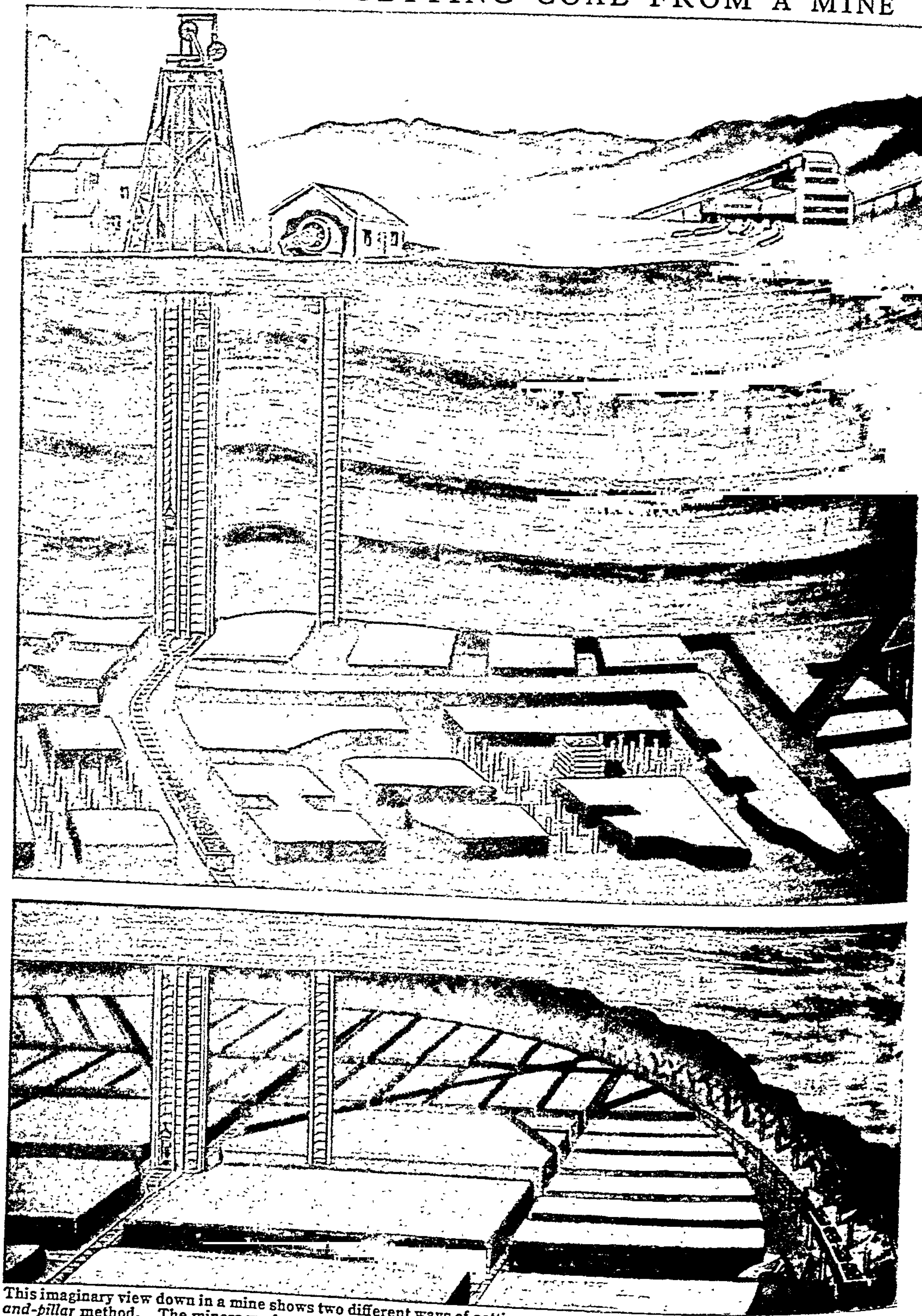
If coal seams lie close to the side of a hill miners reach them by *drift* mining with a level entry If the entry shaft must angle gradually to meet an inclined seam this approach is called *slope* mining

Shaft mining used to reach deep seams *Bituminous coal usually lies in* fairly level seams or veins It can be reached by pushing passages (galleries) out from the shaft The coal is loaded on cars that roll to the elevator



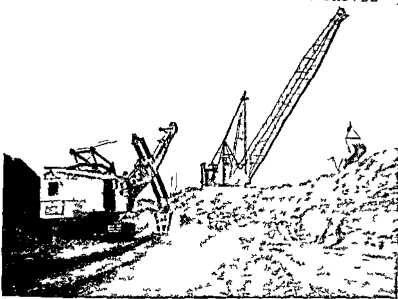
Anthracite (hard coal) was made in places where the rock was folded and tremendous heat and pressure hardened the coal The seams are twisted or broken and miners must drive galleries at various angles from the shaft to get the coal Small buggies carry coal to the larger cars

TWO WAYS OF GETTING COAL FROM A MINE



This imaginary view down in a mine shows two different ways of getting out coal. The upper cutaway view shows the *room-and-pillar* method. The miners work out from the shaft, digging "rooms" in the coal. They leave wooden props and pillars of coal behind to hold up the roofs of the openings. In *longwall* mining (lower level) the miners cut passages to the outer limits of the company's coal. Then they work inward, taking out all the coal. They use props where they work, but let the roof collapse behind them.

OPEN CUT MINING BY DRAGLINE AND SHOVEL



At an Indiana open cut mine a walking dragline strips off the overburden of earth and rock and a dipper shovel digs out the coal The Diesel powered dragline carries nine cubic yards of earth and rock in its bucket The lateral boom is 150 feet long

The simplest method is *strip* or *open-cut* mining It is used where the coal lies close to the surface Huge digging machines strip off the overburden of earth and rock from the coal Then the coal is blasted and dug out with power shovels

The other methods require driving a shaft to reach the coal seam Miners must work underground and send coal to the surface by car

Where a shaft can be driven straight into the side of a mine like a tunnel the method is called *drift* mining *Slope* mining is used where the shaft must go down at an angle to meet a tilted seam *Shaft* mining sends the shaft straight down to the coal seam

Room and Pillar and Longwall Mining

The picture on the opposite page shows two different methods of working sidewise from a shaft The *room-and-pillar* method is used most frequently for seams that are four feet thick or more The miners drive long tunnels called *entries* away from the bottom of the shaft These serve as roads for hauling the coal back to the shaft The men work off these entries into rooms to take out the coal In time the entries and connecting passages make a pattern much like city blocks The miners use timber posts to help support the roofs of passages and rooms They also leave pillars of coal at regular intervals When a mine has been nearly all worked out by this method some coal pillars may be taken out to get the coal in them

In the *longwall method* long entries are driven to the limits of the mine Then the miners work back to the shaft along the whole face of the seam As mining progresses the mined-out area comes more and more to resemble a semicircle This method takes out all the coal but the roof must be supported entirely by timbers As they near the shaft the miners pull out the timbers in the worked-out area and let the roof cave in behind them

A Miner s Working Day

The miner gets up early in the morning and eats a big breakfast His wife packs a lunch ready for him to carry below He has no regular lunch hour He eats whenever his work allows him some free time

Coming to work he goes to the wash house and changes to his working clothes At the lamp house he receives a light to wear on his hat He straps storage batteries for the lamp on his belt or back

Now he goes to the *tipple* (at a bituminous coal mine) or the *breaker* (at an anthracite mine) This building stands on top of the shaft Here also coal taken from the mine is unloaded from the cars and sorted He enters an elevator car called a *cage* that takes him swiftly down to the working area This may be from 100 to 3 000 feet below ground in the United States mines In Belgium mines are sometimes three-quarters of a mile deep

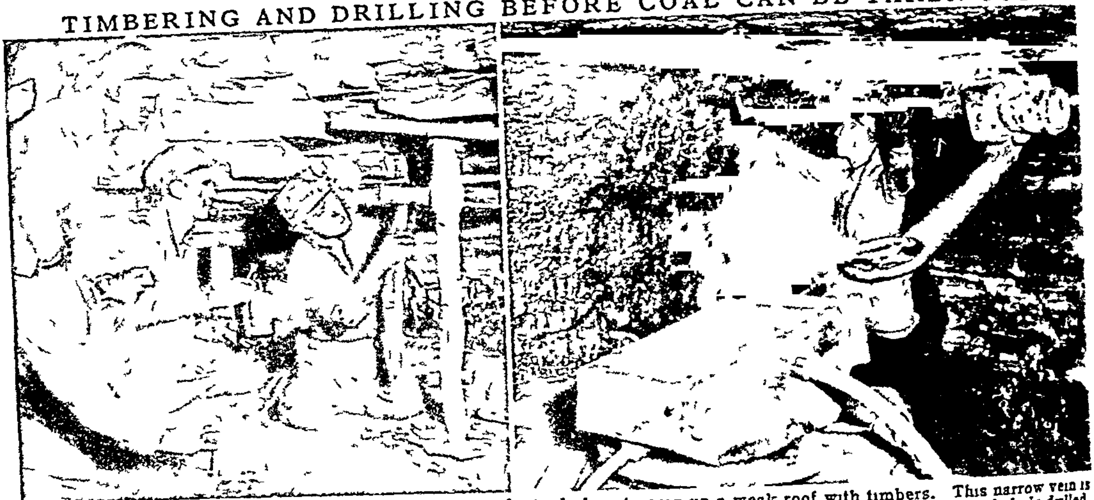
At the bottom of the shaft the miner gets a metal identification check He turns this in at the end of the day to show that he has left the mine If a check is missing a searching party must be sent out to find the lost miner From the shaft bottom he rides to where he will work for the day in a low slung coal car pulled by an engine The cars are called *trips* They carry the miner to his work and back and carry coal out to the shaft When men ride in them the cars are called *man trips* Each string of trips has a motorman and a trip rider who works like a brakeman on a railroad Other men have railroadlike jobs as well Among them are tracklayers road cleaners and switchmen

Working at the Coal Face

Each place where coal is being taken out is called a *face* Work is directed by a foreman called the *face boss* At each face the miners work with electrically powered cutting and loading machines These machines may have been brought to the face on the tracks used by the trips or they may have their own caterpillar treads

Two men operate each machine First they place the cutting machine against the face It has a chain

TIMBERING AND DRILLING BEFORE COAL CAN BE TAKEN OUT



A veteran British miner (left) shows young men learning the trade how to prop up a weak roof with timbers. This narrow vein is typical of British coal mines. An American miner (right) is drilling a blasting hole deep into the coal face. When the hole is drilled, he will insert an explosive along with a fuse or detonator. Then from a safe distance he will detonate the fuse.

with knifelike blades moving parallel to the floor. The machine cuts wide gashes into the face, about six to nine feet deep. Then miners drill holes into the coal and stuff explosives deep into the face.

In some mines there are special workers, called *shot firers*, who do nothing but fire these explosives. In some mines, also, shots are fired only when the other miners have left the mine. Then miners on the following shift load the coal brought down. When the miners are present, they retreat to a safe distance. Sometimes compressed air or carbon dioxide is used for blasting. Both of these are safer than explosives because they require no fuse or electric spark. The released pressure of the gases does the work.

The blast throws lumps of coal to the floor. This coal is loaded into cars and taken to the shaft to be hoisted to the surface. No miner handles the coal after blasting. In most mines a loading machine sweeps the coal onto a conveyer belt. Some mines have a completely mechanized system for picking up coal at the face and hauling it all the way to the shaft and up to the surface. Usually, however, the conveyer belt loads small cars called *buggies*. These take the coal to the trips in the entries. Sometimes the trips run all the way to the face.

When the miner's work day is done, he rides back on the trip to the bottom of the shaft. He turns in his check and rides the cage to the surface. There he returns his lamp and batteries to the lamp house, where the batteries will be recharged. He cleans up and changes clothes at the wash house, and returns home.

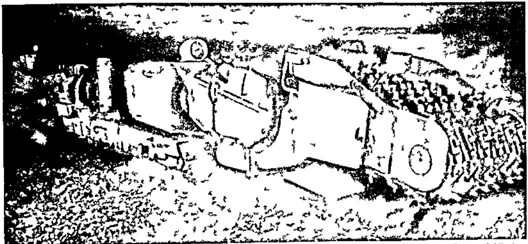
MECHANIZED CUTTING RELIEVES PICK AND SHOVEL WORK

This large electric cutting machine saws deep gashes into the coal face. Then an explosive charge tumbles the coal in great chunks to the floor. The miner near the face is shoveling away coal chips brought out by the cutting knives. This machine runs on tracks to the face. Others may run on caterpillar treads

Sorting and Cleaning the Coal

From the shaft the coal goes to the tipple or breaker. First it is weighed. If any rock remains in the coal it must be washed out or picked out by hand. Then the coal is screened into different sizes. Large pieces must be broken up Anthracite regularly require breaking, hence th building is called

A MECHANICAL MINER WHICH DOES THE WORK



The continuous miner combines all operations usually done by blasting cutting drilling and loading Carbide tipped bits tear the coal from the face and conveyers carry it back to waiting cars The machine can handle two tons of coal a minute

breaker instead of a tipple The coal is washed with water or blown with air to recover some of the fine coal powder Then the coal is loaded into railroad cars for shipment

Sizes and Kinds of Coal

Coal is sold according to sizes *Broken* is the largest anthracite size *block* or *lump* the largest bituminous Then for both types come *egg stove nut pea buckwheat rice* (*buckwheat No 2*) *barley* (*buckwheat No 3*) and screenings Larger sizes are commonly used in hand fired furnaces medium in automatic stokers and the smallest in blower fired boilers

Run-of mine coal widely used in industrial plants is sold at the mine without sifting *Pocahontas* is a trade name for a semibituminous smokeless coal mined chiefly in West Virginia *River* coal—coal washed away from the mines by flood waters—is dug up by dredges from the Susquehanna Schuylkill and Lehigh rivers of the Pennsylvania coal fields *Cannel* coal is named for its bright candlelike flame One of the largest supplies is in West Virginia

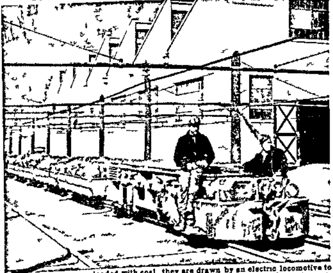
Preventing Accidents

MINE operators and miners maintain ceaseless vigilance to prevent accidents The accident rate has fallen considerably since modern safety methods were developed But no amount of care can eliminate all the hazards One man is killed for about every million tons of coal mined or for about every million man hours worked About 45 men are hurt for every million man hours worked

The greatest danger is from rock or coal falling from the overhead strata or roof The miner frequently tests the roof by tapping it with a heavy object A long loud vibration means that the roof is unsafe To secure the roof the miner supports it with timbers or roof bolts The bolts are long rods that extend three or four feet into the strata and tie the thin layers together In many mines *timbermen* do nothing but erect timbers or place roof bolts

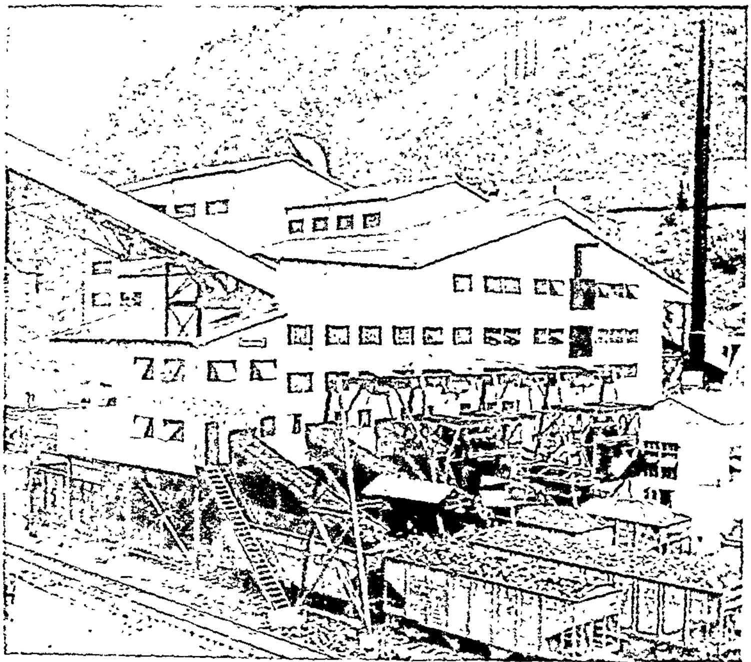
Hauling coal from its loading point to railroad cars on the surface causes the second greatest number of accidents Increasing use of conveyers instead of

ON THE WAY TO THE TIPPLE OR BREAKER



After cars or *trips*, are loaded with coal they are drawn by an electric locomotive to the tipple or breaker for cleaning and sorting At the throttle is the motorman Alongside him is the *trip rider* The building in back is a machine shop

COAL POURS FROM THE TIPPLE TO WAITING CARS



At this bituminous coal-mine tipple, coal is cleaned and sorted. (The building is called a breaker at anthracite mines.) The various classes of coal are then poured down chutes into railroad cars to be transported to distributors or consumers.

individual cars is tending to reduce injuries from this cause. The general widespread use of machinery has also brought with it certain hazards. Moving cumbersome pieces of equipment in confined spaces sometimes results in unavoidable accidents. So does the use of explosives for blasting coal away from the face. But use of compressed air instead of explosives is tending to reduce such accidents.

Safeguards against Gas and Dust

When coal was formed, most of the gases from decomposing matter were squeezed out. But *methane* was entrapped in the coal itself. It has no odor and is highly explosive. Guarding against methane consists chiefly of drawing fresh air through the mine. The quantity of air varies from 50,000 to 500,000 cubic feet of air a minute, depending upon the size of the mine.

Nearly all mines have a separate ventilating shaft. A fan either pushes air down the ventilating shaft or draws it up the main shaft. To prevent air currents from being diverted, abandoned areas are sealed by a *brattice*. Temporary brattices are made of wood and canvas; permanent ones are of tile, brick, or concrete. To detect accumulations of methane, a *fire boss* tests the air before the shift goes to work. He uses a flame safety lamp or an electrical detector.

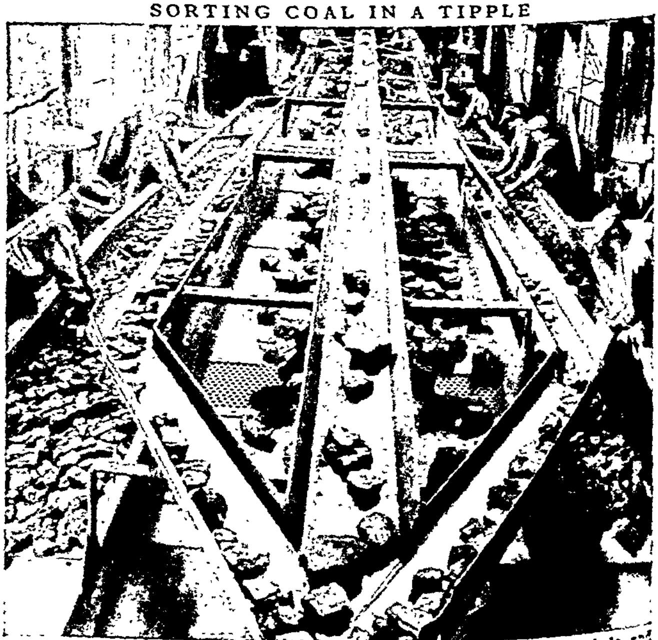
Concentrated coal dust around a flame or spark will start an explosion; and only a little dust in the air beyond will continue the flame. To eliminate this hazard, water is sprayed on the coal when loaded and again at transfer points. The mine surfaces are *rock-dusted* with ground limestone. This dilutes the coal dust and prevents the spread of flame.

Safety inspections are made constantly. The mine examiner, employed by the mining company, works full time to prevent accidents. The mine manager is also responsible for safe working conditions. State inspectors make regular visits and have legal power to see that unsafe conditions are corrected.

Social and Economic History of Coal Mining

THE USE of coal for heating grew up in England and elsewhere at about the same time the American colonies were being settled. Many English mines were troubled by flooding, and the demand for efficient pumps brought the invention of the steam engine, about the time of the American Revolution (see Steam Engine). Steam engines needed coal for fuel, and

SORTING COAL IN A TIPPLE



Coal directly from the face is called "run-of-the-mine" coal. Slate, shale, and other rock must be removed, and the coal must be sorted by size into different groups. The men along the sides of the chutes are both cleaning and sorting.

coal mining became a major industry (*See also* Industrial Revolution.)

In the early days of this growth the work was done entirely by hand under terrible working conditions. In England men crouched in the narrow seams digging the coal away from the walls with hand picks. Women and children dragged the coal to the sur face in baskets, crawling on their knees in the low entries. At the tipple children sorted the coal from the rock. All worked under these appalling conditions 12 to 14 hours a day, six days a week.

A similar situation prevailed in the United States. Additional evils crept in because the mines were in isolated districts far from the big cities. The mine owner or operator completely dominated the little town. He owned the miner's home and the store where the miner's wife traded. Sometimes he paid the miner in "scrip," good only for rent and for trade at the company store. During slack seasons the miner went in debt to the operator, and years passed before he could free himself.

ROCK-DUSTING TO PREVENT EXPLOSIONS

These men are spraying a finely powdered rock dust along the roof, walls, and floor of a coal mine to settle the highly explosive coal dust. Only a little coal dust in the air is enough to cause an explosion if set off by a spark from an electric motor or an unguarded flame from a testing lamp.

Gradual Improvement in Conditions

In the half-century before the first World War coal mining was one of the fastest growing industries in the country. Production doubled every eight or nine years. Working conditions for the miners also improved gradually.

Part of the gain came from a gener al advance throughout all industry. Many of the abuses had come about as part of the national growth and westward expansion. Not much thought was given the fate of workers in coal mining or any other industry. After 1900, however, most of the pioneer work had been accomplished and the American public began taking action to end abuses. Employer's liability laws, safety movements, and legislation cut down the accident toll. Better roads and new means of communication such as telephones and motion pictures helped to break down the isolation of many mining districts. Coal miners benefited somewhat from the general advance, and the miners aided their own cause by collective action.

CORRECT SAFETY GARB

This miner is wearing steel reinforced shoes, a safety helmet, and protective glasses. He is carrying a safety lamp to test for bad air.

Growth of Unions

From the start of the industry miners banded together to fight for better ment. The first national association of coal miners was formed in 1861. Although it was soon dissolved, operators in Pennsylvania were still opposed by the "Molly Maguires," a secret brotherhood of Irish miners. Both sides used violence in their quarrels and the Federal government broke up the brotherhood in 1877.

Miners began to gain strength with the formation of the United Mine Workers of America (UMW) in the late 1880's. The union won its first collective bargaining agreement in 1898 with bituminous operators. Anthracite miners won a similar agreement after a bitter strike in 1902. President Theodore Roosevelt helped establish methods of negotiation that still exist today in labor disputes (*see* Roosevelt, Theodore).

Setback and Recovery

After 1900 population growth slowed down. At the same time other fuels began competing with coal. Increased efficiency in the use of coal itself slowed the demand. After the first World War the number of miners and the capacity of mines were in excess of normal requirements. Coal prices declined and cutthroat competition prevailed. As prices went down wages suffered, for they accounted for 60 per cent of the cost of mining. Between 1924 and 1929 more than 3,000 mines were abandoned and 200,000 men lost their jobs. An awkward factor was the so-called *captive* mine—one operated by a large consumer such as a steel company to meet its own coal needs.

For many years Congress struggled with the problem of devising legislation which would help restore normal profitable operation without opening the way to monopolistic practises. In 1937 it passed the

Bituminous Coal Act, which outlawed unfair competitive practises, established collective bargaining on an industry-wide basis, and provided for establishing fair minimum prices.

At this same time, the UMW rose rapidly to new power as a collective bargaining agent under the leadership of John L. Lewis (*see* Lewis, John L.). One effective bargaining device was the policy of "no contract, no work," sometimes taken when an existing contract between operators and the union expired and no new one had been agreed upon.

HOME AFTER WORK

Where the mine does not provide a wash house, the miner cleans up at home. He leaves his dirty clothes by the kitchen door before scrubbing up.

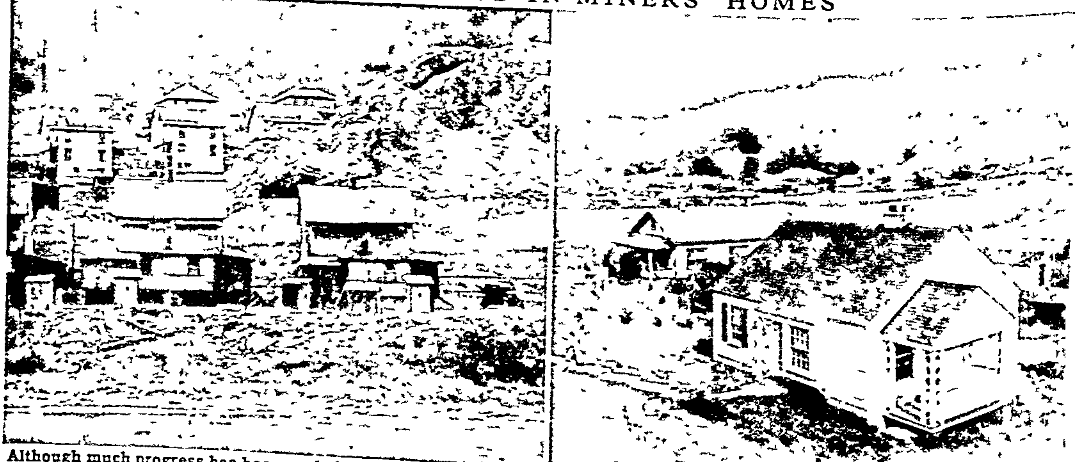
During and after the second World War, this heightened bargaining power transformed the economic position of the miners. From 1939 to 1949, the average weekly pay of miners tripled. The miners won *portal-to-portal* pay—that is, pay for time spent in traveling from the wash house to the coal face and return, as well as actual work at the coal face. This travel time often meant a half-hour each way. They also won a benefit fund, supported by a royalty paid for every ton of coal mined. From this fund accident benefits and old-age pensions were paid. The miners also drew social security benefits.

Congress tacitly acknowledged the rise of union power by allowing the Bituminous Coal Act to expire in 1943. But the government and the public were also reminded from time to time that the union could paralyze the nation by industry-wide strikes. In 1946 the government seized the mines under its unexpired war powers to forestall such a strike. When the union struck despite an injunction forbidding interference with government operation, it was fined $700,000 and Lewis was fined $10,000. In 1948, defiance of an injunction obtained under the Taft-Hartley act brought fines of $1,400,000 and $20,000 respectively. But after a strike in 1950 no fines were imposed. The court ruled that the UMW had not defied a federal injunction. A new contract brought increased benefits to the miners.

COAL-TAR PRODUCTS. One of the favorite raw materials of the research chemist is coal tar. Coal tar is a black gummy substance, a by-product in the manufacture of illuminating gas and coke. It is a mixture of exceedingly complex organic substances out of which a chemist seems able to dig almost anything he wishes, from a disinfectant to a grease-spot remover, from a dye to a perfume, from drugs and fertilizers to explosives. The tar yields only about a dozen primary substances, but from these the chemist builds up thousands of new compounds. The United States coal-tar industry is a recent development. German chemists pioneered in this field and had almost a monopoly of it until the first World War. Cutting off imports from Germany gave the American industry its start.

Coal tar is distilled in huge cylindrical iron stills capable of holding 20 tons of tar. The first *fraction*, that is, the part having the lowest boiling point, is made up of the light oils and naphthas, including benzol, toluol, and xylol. From benzol is made the

BAD AND GOOD IN MINERS' HOMES



Although much progress has been made in providing miners with clean and pleasant homes, there still remain many squalid houses (left) in mining towns. Unpainted shacks with outdoor privies stand starkly against the scarred hillside. At right, trim cottages with neat gardens show that miners and mine owners are eager to work together to raise living standards.

pure benzene, from which in turn are made aniline and its related dyes (*see* Dyes) Toluol is the source of benzaldehyde, a synthetic perfume called oil of bitter almonds and used for scenting soap Another product of toluol is benzoic acid Its salt, sodium benzoate, is used as a food preservative TNT, a powerful explosive, is a product of toluol (*see* Explosives) So is saccharin, hundreds of times sweeter than sugar and sometimes used as a substitute for it Xylol is the source of numerous dyes From benzene and toluene medicinal preparations are made, including antiseptics, antipyretics, and hypnotics The chemical formulas of benzene (C_6H_6), toluene (C_7H_8), and xylene (C_8H_{10}) indicate their kinship

The next fraction, which boils at a higher temperature than the first, contains carbolic oils (*see* Carbolic Acid) From carbolic acid (also called phenol) are made dyes, picric acid, and the salicylic acid which is used as an antiseptic, as a treatment in rheumatism, and as a base for hypnotics and for anodyne drugs such as aspirin Another substance from phenol is synthetic coumarin This tastes so much like vanilla extract that it is used as a substitute Cresols, which are chemically similar to phenol, are also in this fraction They can be used as disinfectants even without purifying, 'lysol' and 'creolin" are commercial names for cresols

The next fraction contains naphthalene creosote oils, and quinoline Naphthalene is used to make dyes—indigo, buttercup yellow, scarlet pink, and green It is also the source of many medicines But it is best known in the form of moth balls Creosote oils are used to preserve wood (*see* Creosote) Quinoline is an antiseptic and it also yields many dyes

Anthracene oil, the next fraction, is the source of alizarin dyes, especially important in printing cotton textiles After the anthracene has been distilled, there remains in the still only a black sticky pitch If a soft pitch is desired, some of the anthracene is left with it in the still Pitch is used in making roofing paper, wood preservatives, and paints, in binding coal dust together to make briquettes for fuel and in paving materials

By the Bergius process tar is *hydrogenated* at high temperatures and high pressures with a catalytic agent, and converted into a petroleum like substance from which fuel oils and spirits are obtained by distillation (*see* Hydrogen)

From phenol, cresol, naphthalene, and other coal-tar products the modern industrial chemist makes many useful plastic materials including Bakelite (a trade name), formica, micarta, and many others (*See also* Plastics)

COAST GUARD, UNITED STATES *Semper paratus*—"always prepared"—is the appropriate motto of this military branch of the government It is primarily the *nation's police power on* the high seas and on navigable waters of the United States, but its range of duties has been extensively enlarged to include a far more varied scope of activity The highly trained personnel and excellent equipment are devoted not only to law enforcement but also to a long list of collateral services

It enforces federal laws relating to customs and the prevention of smuggling. It polices harbors and enforces the regulations pertaining to navigation and merchant shipping, immigration, quarantine, and neutrality It maintains aids to navigation (*see* Lighthouses and Lightships) It protects the fisheries, certain game and bird reservations, and the fur seals of Alaska (*see* Seal)

Among its other duties are saving life and property at sea (*see* Lifesaving Service) flood and hurricane relief, and caring for shipwrecked property It destroys derelicts (abandoned ships) and other obstructions to navigation It conducts the international service of ice observation and ice patrol in the North Atlantic (*see* Icebergs) It carries medical aid to vessels at sea In cooperation with the Weather Bureau, it stations vessels far at sea to provide weather information for transoceanic air routes It collects and transmits reports of floods, hurricanes, storms, and other weather conditions It operates the coastal communications system, compiles statistics of marine disasters and makes oceanographic investigations

In peacetime the Coast Guard operates as a service in the Treasury Department In time of war, however or when the president directs the Guard is transferred to the Navy Department and acts as part of the Navy, continuing its usual routine as far as it is able The chief officer of the service is the commandant who is appointed by the president

Besides its shore establishments the Coast Guard has a fleet made up of cruising and patrol cutters and special duty vessels including icebreakers buoy tenders ocean and harbor tugs and freighters The aviation wing comprises air stations and planes

Personnel of the Coast Guard

Officers are trained at the Coast Guard Academy at New London, Conn Candidates must be single, 17 to 22 years old The scholastic requirements are similar to those of engineering colleges The four years' course, leading to a B S degree, is basically science and engineering A nation-wide competitive examination is held annually, the number of appointments made is decided by the Treasury Department and depends upon the needs of the service Cadet graduates are commissioned as ensigns in the Coast Guard Promotion and pay parallel those of the corresponding ranks in the Army and Navy (*see* Army)

The Coast Guard Reserve is made up of officers and enlisted men *between the ages of 17 and 55* A Women's Reserve, the SPARS, served during the second World War until demobilized in 1945 It was reactivated in 1951 The Coast Guard Auxiliary is a volunteer nonmilitary organization which is composed of owners of motorboats and yachts

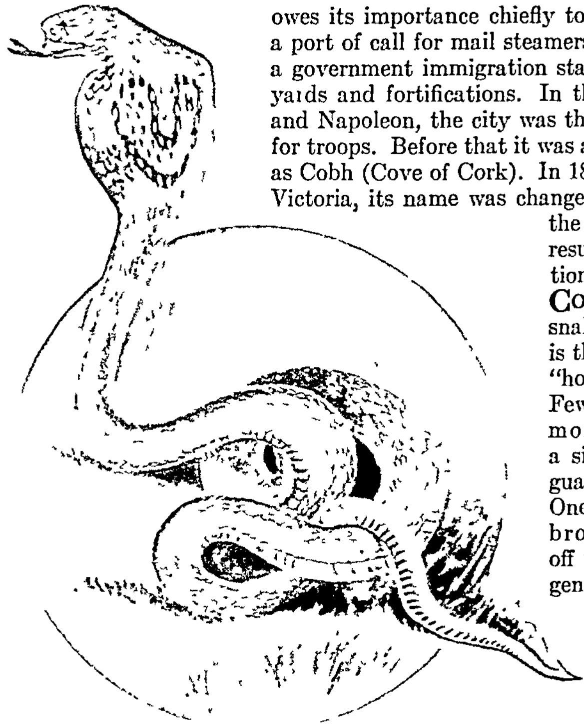
Long History of Service

The Coast Guard dates from 1790 when Congress established the Revenue Marine (later called Revenue Cutter Service) to prevent smuggling This was the only sea force of the new nation as the Continen-

tal Navy had been disbanded. In 1915 the Revenue Cutter Service was combined with the Lifesaving Service as the Coast Guard. In 1939 it took over the work of the Bureau of Lighthouses, which had been established in 1789 as the Lighthouse Service.

In national defense, the Coast Guard has a long record of service. During the dispute with France in 1798 and 1799, the Revenue Cutter Service captured French privateers. In the first World War it convoyed troop and supply ships through the submarine-infested Atlantic. Again in the second World War it performed this hazardous duty. In addition, Coast Guardsmen manned many of the landing craft used in the invasions in Europe and in the Japanese-held islands of the Pacific (*see* World War, Second).

DANGER—KEEP CLEAR!



This India cobra is tense and alert. It holds its head high. With its flaring hood opened wide and forked tongue flickering in and out, it weaves gently from side to side as it watches the motions of some man or animal.

COBALT. When the early chemists worked with metals they were often bothered by a substance that occurred with copper and iron and was very hard to separate. They called this substance "cobalt" because it plagued them like kobolds—mischievous gnomes of German tales.

Georg Brandt, a Swedish chemist, first succeeded in reducing cobalt from its ore in 1735. This silvery white element is slightly harder than iron or nickel, to which it is closely allied. It is magnetic and resists corrosion. It forms valuable alloys used in permanent magnets for radio speakers and radar equipment, in jet-engine parts, and in high-speed machine tools (*see* Alloys). It is a binder for cemented carbides for cutting hard materials. Its salts are driers for paints and varnishes. An invisible ink from chloride of cobalt darkens when it is heated. Cobalt oxides bond porcelain enamel to steel. Cobalt yellow, green, and blue are fine pigments for glazing pottery, for glass, and for enamelware. A deep-blue pigment, *smalt*, is made by fusing silica, potash, and cobalt. Cobalt is important as a catalyst in chemical processes. Radioactive cobalt, made in atomic furnaces, is used to treat cancer.

The chief ores are *smaltite* and *cobaltite*. The Belgian Congo produces about three fourths of the world's cobalt. Other producers include Northern Rhodesia, the United States (Pennsylvania and Idaho), French Morocco, and Canada (at Cobalt, Ontario).

COBH (*kôv* or *kōb*), **IRELAND.** In Cork harbor, on Ireland's south coast, Great Island rises abruptly from the water (*see* Cork). Built like an amphitheater on the island's steep southern end is the city of Cobh (Queenstown), its handsome streets rising like terraces one above the other. Because of its mild climate the island is a favorite resort, but the city owes its importance chiefly to its fine harbor. It is a port of call for mail steamers, a naval station, and a government immigration station, with large dockyards and fortifications. In the wars with America and Napoleon, the city was the port of embarkation for troops. Before that it was a fishing village known as Cobh (Cove of Cork). In 1849, in honor of Queen Victoria, its name was changed to Queenstown, but the old name was officially resumed in 1920. Population (1951 census), 5,711.

CO'BRA. Of all poisonous snakes, the most feared is the *cobra de capello*, the "hooded terror" of India. Few creatures, indeed, are more terrifying than a six-foot cobra standing guard in a jungle path. One third of its yellowish-brown body is raised off the ground and sways gently from side to side with hypnotic rhythm. The creature's ugly head with its glaring eyes, darting tongue, and hissing breath, is almost surrounded by the hood, a great spoon-shaped expansion of the neck. The awesome appearance of the cobra fits its nature, for it is one of the deadliest of snakes.

Because of its imposing appearance the Indian cobra and its relatives in other parts of Asia and Africa have been worshiped since the beginning of history. In the ancient Egyptian hieroglyphics the figure of the cobra with expanded hood occurs constantly. Even today the many pious Hindus can hardly be induced to kill these dangerous creatures, which are very numerous. Cobras are responsible for a large part of the 20,000 deaths annually due to snake bites in the Indian peninsula.

The cobra feeds on insects, lizards, frogs, and small mammals, and frequently enters human dwellings in search of mice and rats. While it does not seek quarrels, it will not go to great trouble in avoiding them. Once aroused it becomes vicious and aggressive.

Yet with all its dangers, the cobra is the favorite of snake charmers in India, who in many cases do not trouble to extract its poison fangs. These street performers make a show of "charming" the serpent with music of a native pipe. The snake sways as if

it were dancing to the music The cobra is only following the motions of the snake charmer however for snakes show no interest whatever in music

The curious hood of the cobra is formed by the ribs of the neck which the snake can raise and expand at will stretching out the folds of loose skin The common Indian cobra (*Naja tripudians*) displays on the back of its hood a black and white mark which resembles in shape a pair of spectacles

The king cobra or *hamadryad*, is a much larger snake sometimes 13 feet long Though rarer than the common cobra it is equally dangerous Its bite has been known to kill an elephant in three hours It feeds principally on other snakes

The African cobra (*Naja haje*) is one of several snakes to which the name asp has been applied It infests almost all parts of Africa One of its relatives known to the Boers of South Africa as the ring hals has the peculiar habit of spitting its venom to a distance of several feet

Cobras usually live in pairs near the water The female lays about 20 soft shelled eggs in a nest of dried leaves under decayed logs and moss-grown stones The eggs are hatched by the sun One of the cobra s most feared enemies is the mongoose (*see* Mongoose)

COCHINEAL (*kŏch ĭ-nel*) A natural dyestuff called cochineal crimson or scarlet in color is made from the bodies of the cochineal insects (*Coccus cacti*) which are about 1/20th of an inch long They are native to Mexico and South and Central America where they feed principally on the *nopal* cactus but have been widely cultivated elsewhere The coloring matter known as carminic acid is present only in the females which are about 200 times as numerous as the males

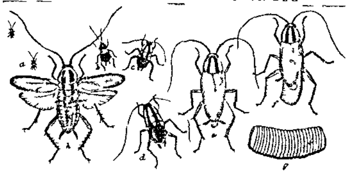
Cochineal dye is now produced chiefly in the Canary Islands and Peru The insects are brushed off the cactus plants just before the egg laying season and are killed in boiling water steam hot ovens or by exposure to the sun The bodies which look like tiny fluted grains are then dried and ground to a powder About 70 000 of them make a pound of dye.

Cochineal has been largely replaced today by artificial coal tar dyes It is still used however in coloring foodstuffs candies certain medicines and cosmetics because it is not poisonous Combined with alum it is the basis of the pigment called carmine lake The cochineal insect belongs to the family *Coccidae* (*see* Scale Insects)

COCKROACH The cockroach is one of our most obnoxious household pests It eats nearly all human foods and injures many other articles such as books which it attacks for the glue and sizing used in the manufacture of the bindings It spreads disease and is a serious menace to public health *since it seeks out* bakeries restaurant kitchens hospitals and food factories of all kinds Its offensive odor *clings to every* thing it touches The only favorable thing that can be said about the cockroach is that it destroys *bedbugs*

Cockroaches thrive in damp warm places near steam and water pipes in walls and baseboards and under floors They lie hidden in the daytime coming out to feast only in the dark Thus they may enter a house and increase greatly in numbers before a housewife finds out they are there Their broad flat bodies permit them to crawl about in narrow cracks and along pipes They can run very swiftly on their long powerful legs The male cockroach has wings but not all species are able to fly the female has only small wings or none The eggs of cockroaches are enclosed in leathery capsules (*oothecae*) which protect them from moisture Each capsule carries from 16 to 56 eggs according to the species

LIFE HISTORY OF THE CROTON BUG



The Croton bug or German roach is one of the commonest species found in dwellings It was so named because it was found in great numbers around water pipes connected with the Croton aqueduct which serves New York City It is light brown with two dark bands on the casing of the head Pictures *a* to *d* show the first four stages of development *e* adult *f* adult female with egg case *g* egg case enlarged *h* adult with wings spread All are natural size except the egg case

This unpleasant pest has one of the oldest pedigrees among living creatures Cockroaches were among the earliest forms of insect life to appear on earth During the Coal Age of the earth s history long before birds and mammals had developed they were probably the most numerous of all insects As their many fossil remains show they have changed but little in the millions of years since

Nearly a thousand species are known most of them natives of tropical countries They vary greatly in size some tropical species being several inches long The native species of the northern United States are found in fields and woods under logs stones and rubbish The commonest household offenders—the German cockroach or Croton bug and the Oriental cockroach—have been brought in on ships and are especially prevalent in seaports One of the most effective means of exterminating cockroaches is to dust the places they frequent with sodium fluoride Pyrethrum powder borax sulphur and phosphorus

paste are also used. Cracks in floors, baseboards, and around pipes should be filled with putty, plastic wood, or other material to prevent cockroaches from entering the home.

Cockroaches belong to the order *Orthoptera*, meaning "straight wings," and to the family *Blattidae*. They are relatives of the grasshoppers, locusts, and crickets, though they look more like beetles. Scientific name of Croton bug, *Blattella germanica;* of the Oriental cockroach, *Blatta orientalis;* of the American cockroach, *Periplaneta americana;* of the common wood cockroach, *Parcoblatta pennsylvanica.*

COCOA. The dried and powdered seed-kernels of the cacao tree; as a beverage, cocoa is made more digestible than chocolate by the removal of part of the cocoa butter, or fat, contained in the cacao "beans." (*See* Cacao; Chocolate.)

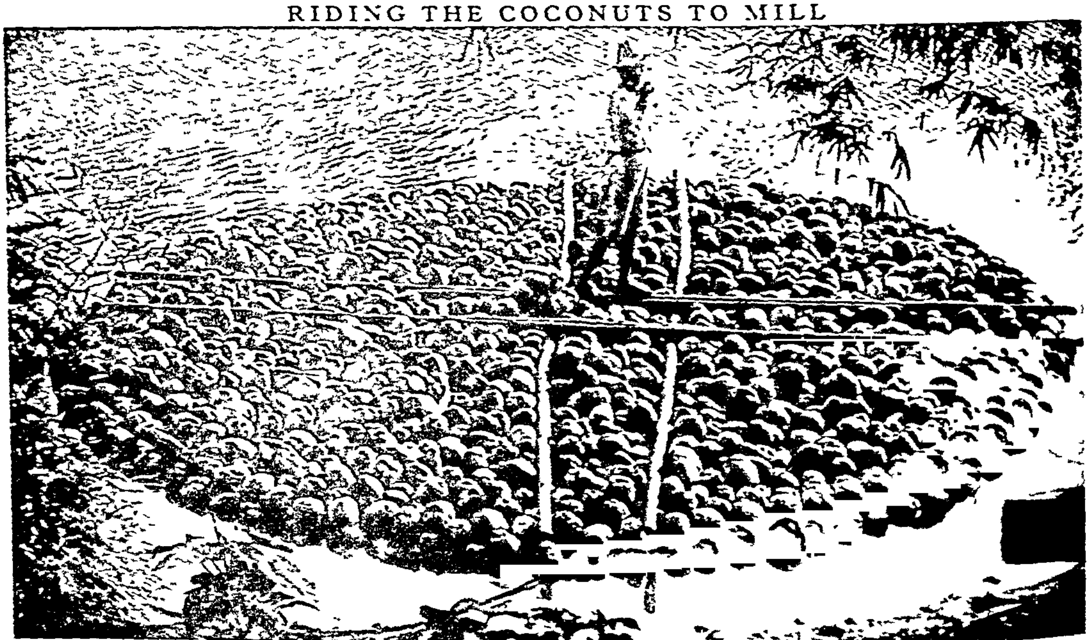
COCONUT PALM. One of the first plants to appear in a newly formed tropical island is the stately and graceful coconut palm. The seed, which is the coconut (also spelled cocoanut) of commerce, is securely protected from the action of sea water by its thick fibrous husk and hard shell. It is thus peculiarly adapted for distribution by ocean waves and currents, and may be carried over a thousand miles from the parent plant to grow on some distant shore.

This fact accounts for its wide distribution. Originally native to certain islands of the Indian Ocean or of tropical America, it is now found on most tropical shores in the East and West Indies, and particularly in the tropical islands of the Pacific Ocean. These beautiful trees lend distinction and attractiveness to the islands. To the cultivation of the coconut is largely due the increasing commerce and rising civilization of many of those remote islands.

The coconut palm is one of the tallest and most ornamental of the palms. Its smooth straight trunk attains a height of 100 feet and is crowned with a cluster of long branched leaves. The fruits or coconuts mature in bunches of from 10 to 20. As they grow they are oblong masses 12 to 18 inches in length and 6 to 8 inches in diameter. A tough fibrous husk incloses the nut, whose hard shell is lined with the food-material, within which again is the so-called coconut milk.

A coconut plantation, when once established, insures its owner a good living for the rest of his life. The coconut palm is easily grown from seed. After the first two years the trees require practically no attention. They begin to bear about the sixth year, and from then on each matures from 50 to 60 nuts a year. The bearing period lasts from 70 to 80 years.

RIDING THE COCONUTS TO MILL



In the Philippine Islands coconuts are sometimes made up into a raft for floating to the mill. The raft is held together with a framework of sticks and cords, and the nuts are protected from the action of the water by their fibrous husks and hard shells.

No tree known to man has a higher commercial value than the coconut palm. It is also the most useful of all trees to the natives of the regions in which it grows. The fresh meat of the nuts furnishes a nourishing food, and the milky juice forms a pleasant and refreshing drink. The terminal bud furnishes the palm "cabbage" used as a salad vegetable in the tropics. The trunk yields timber, the leaves are used in making baskets and fans and in thatching the roofs of houses; and the husk yields the *coir* fiber which is made into mats, ropes, and brushes. (For illustrations in color, *see* Pacific Ocean.)

The most important article of commerce produced by the coconut is the *copra* or dried nut meat. This

GATHERING COCONUTS IN THE PHILIPPINES

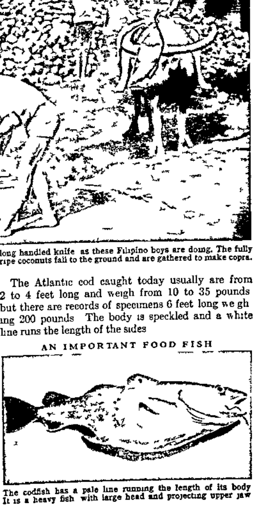
Green half-grown coconuts are best for eating Someone has to climb the trees and pick them or else cut them down with a long handled knife as these Filipino boys are doing. The fully ripe coconuts fall to the ground and are gathered to make copra.

contains from 50 to 65 per cent of coconut oil which has been used as a food in the Far East since the dawn of history In Western countries the oil is largely used in making soaps candles and lubricants The fats of coconut oil are so much like milk fats that they are used extensively to manufacture nut margarine a substitute for butter The scientific name of the coconut palm is *Cocos nucifera* (*See also* Copra Oleomargarine)

Cod One of the world s most important food fishes is the cod It is a salt-water fish found in the colder parts of the North Atlantic and Pacific oceans The Grand Banks of Newfoundland have been an important source of cod for European and North American countries for several hundred years So important were the cod fisheries of early New England that a pine carving of a codfish was authorized by the Massachusetts legislature in 1784 It now hangs opposite the speaker s chair in the Statehouse

The Atlantic cod caught today usually are from 2 to 4 feet long and weigh from 10 to 35 pounds but there are records of specimens 6 feet long weighing 200 pounds The body is speckled and a white line runs the length of the sides

AN IMPORTANT FOOD FISH



The codfish has a pale line running the length of its body It is a heavy fish with large head and projecting upper jaw

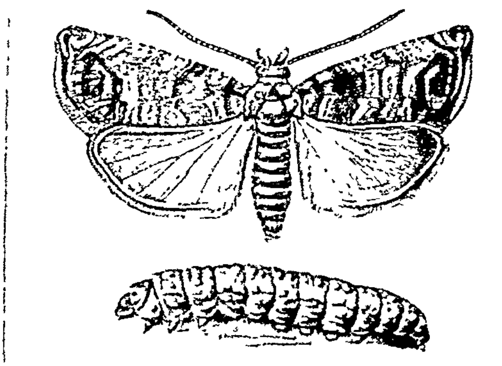
Spawning takes place along the New England coast from October to June. The female lays an enormous number of eggs. As many as 8 million have been found in a single fish. The newly laid eggs and the young have countless enemies. Pollock are very destructive of young cod. Cod in turn feed on herring, lobsters, and many other forms of sea life.

Cod are usually taken at depths of 48 to 240 feet, but they are known to inhabit much deeper water. The fish are unloaded from a dory into a mother ship, where they are immediately cleaned and packed in salt. The livers are set aside for their valuable oil. Most of the United States catch is now filleted and sold either fresh or frozen, but large quantities are also sold dried. New England scrod is a young cod weighing $1\frac{1}{2}$ to $2\frac{1}{4}$ pounds.

Codfish belong to the family *Gadidae,* to which pollock, haddock, ling, and cusk also belong. The scientific name of the Atlantic cod is *Gadus morrhua;* of the Pacific cod, *Gadus macrocephalus;* of the Pacific tomcod, *Microgadus proximus.* The West coast cods have little commercial importance.

CODLING MOTH. One of the worst insect enemies against which the fruitgrower has to fight is a little gray moth with brown markings. The harmless-looking insect produces the white caterpillar often found in the heart of an apple. Year after year this caterpillar has destroyed much of the apple crop in the United States. Its appetite has cost the country as much as 30 million dollars a year.

THIS IS THE APPLE "WORM"



How often have you bitten into an apple and found a little white "worm"? You may find this insect also in the pear. Here is a greatly enlarged picture of one of the adult caterpillars and its parent, the codling moth.

The codling moth lays its eggs in the appleblossoms. These hatch out into tiny *larvae,* or caterpillars. As the apple forms at the base of the blossom they eat their way into its center. Many of the apples that are infested with larvae drop off the tree before they are ripe. The larvae then eat their way out and spin about themselves cocoons of fine silk threads, attached underneath the bark of apple trees. While they are in this stage (*pupa* stage), large numbers of them are eaten by woodpeckers. When the pupae change to moths, they come out of their cocoons and fly to appleblossoms to lay their eggs for the next brood.

To kill the moth larvae, orchardists spray the trees with Paris green solution or lead arsenate just as the blossoms fall. DDT has also proved effective in controlling the pests. The scientific name of the codling moth is *Carpocapsa pomonella.*

CODY, WILLIAM FREDERICK (1846–1917). A noted American army scout and frontiersman, Cody, better known as Buffalo Bill, later became famous for his Wild West Show. (*See* Buffalo Bill.)

From COFFEE PLANTATION *to* BREAKFAST TABLE

COFFEE. Toward the end of the 3d century after Christ, some monks, fleeing from persecution, found refuge in the highlands of Abyssinia, across the Red Sea from Arabia. There they supported themselves by tilling the soil and raising flocks. One night one of the good fathers whose turn it was to watch the goats and sheep came running to the monastery, pale and trembling.

"The animals are bewitched," he panted. "They gambol and play as if it were a spring morning."

"Peace, my son; you have been dreaming," the prior reassured him. "Rest here and I will go to the fold."

The prior too found the animals frisking and romping in the moonlight instead of sleeping as they should. Night after night this continued, in spite of prayers and exorcisms. By observing what plants the animals browsed on, the prior at last convinced himself that the sleeplessness was due to the leaves and fruit of a certain unfamiliar shrub which grew there in profusion. Picking some of the ripe cherrylike fruits, he chewed the seeds and found that he too felt an unusual exhilaration and was wakeful that night.

Thus coffee was discovered, according to one of the many legends current among the Arabs. However fanciful the story may be, the fact remains that Abyssinia and Arabia were the original homes of the coffee shrub. We also know that by the 15th century pilgrims to Mecca used to drink an infusion of the roasted coffee bean to prevent drowsiness during the long religious services of the Mohammedan faith.

How the World Learned to Drink Coffee

From Arabia the practice passed to Constantinople, and thence to Venice, and to England, France, and other European countries, largely through the example of the Turkish ambassadors. Coffeehouses sprang up and soon became the favorite resorts of people of fashion, political leaders, artists, and men of letters. From the associations thus formed our modern clubs developed. The first coffeehouse in London was established in 1652, and within 20 years such places had come to play so important a part in the social and political life of the day that Charles II attempted to repress them on the ground that they were "semina-

HOW A CUP OF COFFEE STARTS IN BRAZIL

1. Clustered flowers of white turn into ripe cherrylike berr es of dark red 2 Pickers strip off low berries onto a canvas and reach h gh ones by ladder 3 Raked through a washing trough the ripe berries sink and pass out through a sluice 4. W th frequent turnings the berries are dried by sun and wind 5 After be ng hulled and graded the green coffee beans (in 132 pound bags) are loaded on ships and carr ed to d stant markets where they are blended and roasted

ries of sedition." In Paris, too, many coffee houses were set up. How important they became is shown by the fact that one of our common names for a restaurant (*café*) is the French word for "coffee" or "coffee house."

More coffee is consumed in the United States than in any other country in the world, though the Scandinavian countries use slightly more in proportion to population. The United States takes from 65 to 75 per cent of the world's export crop, using more than 18 pounds—the equivalent of approximately 750 cups—a year per person.

Until the end of the 17th century all the coffee of commerce came from Arabia, being shipped from Mocha (or Mokha), once the capital of the province of Yemen. Thus we get the name Mocha, which is still applied to all Arabian coffee as well as to coffee resembling the Arabian in color and taste. Coffee cultivation thence spread to the island of Java, in the East Indies, and finally throughout the tropics of both hemispheres.

How One Coffee Tree Supplied the New World

The vast plantations of Brazil and the West Indies, which grow nearly three fourths of the world's coffee, are said to be the offspring of a single coffee tree. A few plants, brought from the Dutch plantations in Java, were presented to the King of France. These he sent to the West Indies to be planted. The voyage was long and tempestuous, and one by one the plants died, until only one was left. Water became scarce, and the faithful officer to whom the mission had been entrusted divided his scanty allowance with the plant, which lived and became the parent tree for the plantations of the New World.

To visit a coffee plantation, we must go farther south than the United States, for the plant needs a warm climate where the temperature never falls below 60 degrees. Neither will our visit take us to lowlands, for coffee thrives best 800 to 5,000 feet above the sea, where the soil is rich with red iron rust or with the gray soil of volcanic rocks. The air must be fresh and dry, and the land hilly, so that drainage will be easy. If you look at a map of Brazil, you will find that the great coffee-producing states of São Paulo and Rio de Janeiro lie in the uplands near the coast just within the tropics. The chief coffee-growing regions, after Brazil, are Colombia, Venezuela, Central America, Mexico, Arabia, parts of Africa, and India, East Indies (Indonesia), West Indies, and the Pacific Islands, especially Hawaii and the Philippines.

As we approach a *fazenda* or coffee orchard the wind sweeps out a great wave of fragrance like that of white honeysuckle, but far sweeter. So completely is the dark shiny foliage covered with the starry jasmine-like flowers that it looks as though a shower of snow had fallen on the slender trees. There is a great fluttering and buzzing of gorgeous butterflies, bees, and locusts; and myriads of brilliant humming-birds dart about the trumpet-shaped flowers. As we come nearer we notice armies of ants, marching and countermarching between their nests and the trees. They are very useful in keeping in check the insect pests that ravage the coffee plants.

The wild varieties of coffee grow 20 feet or more in height, but the cultivated trees are kept trimmed to 6 or 10 feet, so that the berries may be picked more readily. The cherry-like berries change from green to light yellow, then to scarlet, and last of all to a deep

A COFFEE PLANTATION IN BRAZIL

Set in among rolling red hills covered with the glistening green of myriad rows of coffee trees, are the white buildings of this typical plantation in the state of São Paulo, Brazil, richest coffee-growing district in the world. Spacious drying grounds and long storage houses stretch away from the "fazenda," as the residence of the planter is called, around which cluster the laborers' quarters. Whole families join in the work of harvesting, which lasts as a rule from April to August The bushes are stripped of all berries; green, ripe, and withered are all put into the same bag and sorted later.

crimson or black When they are ripe, the skin shrivels like an overripe cranberry The sweet yellow pulp covers a pair of oval seeds, lying with their grooved and flattened faces together—the familiar coffee beans Sometimes there is only one seed, called from its shape a pea berry, these are separated from the others, and bring a higher price in the market

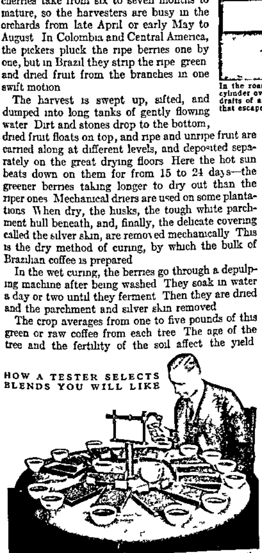
The chief blooming season in Brazil comes in the South American springtime months, between September and November The cherries take from six to seven months to mature, so the harvesters are busy in the orchards from late April or early May to August In Colombia and Central America, the pickers pluck the ripe berries one by one, but in Brazil they strip the ripe green and dried fruit from the branches in one swift motion

The harvest is swept up, sifted, and dumped into long tanks of gently flowing water Dirt and stones drop to the bottom, dried fruit floats on top, and ripe and unripe fruit are carried along at different levels, and deposited separately on the great drying floors Here the hot sun beats down on them for from 15 to 24 days—the greener berries taking longer to dry out than the riper ones Mechanical driers are used on some plantations When dry, the husks, the tough white parchment hull beneath, and, finally, the delicate covering called the silver skin, are removed mechanically This is the dry method of curing, by which the bulk of Brazilian coffee is prepared

In the wet curing, the berries go through a depulping machine after being washed They soak in water a day or two until they ferment Then they are dried and the parchment and silver skin removed

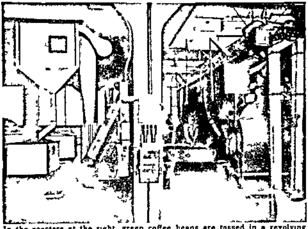
The crop averages from one to five pounds of this green or raw coffee from each tree The age of the tree and the fertility of the soil affect the yield

HOW A TESTER SELECTS BLENDS YOU WILL LIKE



After examining the roasted sample in the tray and tasting the "draw" in the cup the coffee tester knows how best to blend it with other kinds to suit particular tastes

TURNING GREEN COFFEE TO BROWN



In the roasters at the right green coffee beans are tossed in a revolving cylinder over a fire coming out brown and pleasantly flavored Then strong drafts of air suck them up through pipes, leaving behind any small stones that escaped previous sifting From the bin on the ceiling (left), the beans are drawn off into conveyors

Packed into bags weighing 132 pounds each the coffee starts on its voyage to the seaport and the ships that will carry it to the markets of the world

At a wholesale establishment experts roast and grind samples of each coffee lot Next sitting at revolving tables, they pour boiling water over a measured quantity of each and smell and taste these 'draws' According to taste they then specify how the different kinds of coffee are to be combined to produce the wholesaler's standard blend

Finally the correct amounts of each kind of coffee are mixed and roasted over fires in huge revolving cylinders Roasting develops the aromatic oils that give coffee its distinctive taste Flavor is improved if raw coffee is aged one to four years Once it is roasted it should be used as soon as possible, since roasted coffee loses flavor with age

Powdered coffee which dissolves instantly in boiling water is made by evaporating a strong brew of coffee in a partial vacuum A crystalline coffee soluble in cold water is made by spraying a coffee concentrate on a continuous steel belt in a high vacuum

National Tastes in Coffee

Americans like their coffee a clear rich brown, usually with cream and sugar added The French are fond of *café au lait*, which is hot milk and strong coffee in about equal proportions In the Orient, the usual practise is to grind the beans as fine as flour This makes a thick black beverage, which is drunk grounds and all In Sumatra a coffee-tea is prepared from the roasted leaves of the coffee plant

The pure food laws of the United States demand that coffee be pure, but in Europe adulteration is general Indeed, many prefer the addition of roasted chicory root which gives a dark rich color to the drink Some prefer coffee substitutes made from grain, or coffee with the stimulant *caffeine* removed This is

done by swelling and softening the bean with steam and ammonia, then removing the caffein with chloroform, before the bean is roasted. Chemically, caffein is identical with the *thein* of tea. It is found in coffee in amounts ranging from one per cent to about two per cent, while the percentages of thein present in tea are twice as great. These two stimulants, combined with the tannic acid present in the tea and coffee, are responsible for the physiological effects of the beverages.

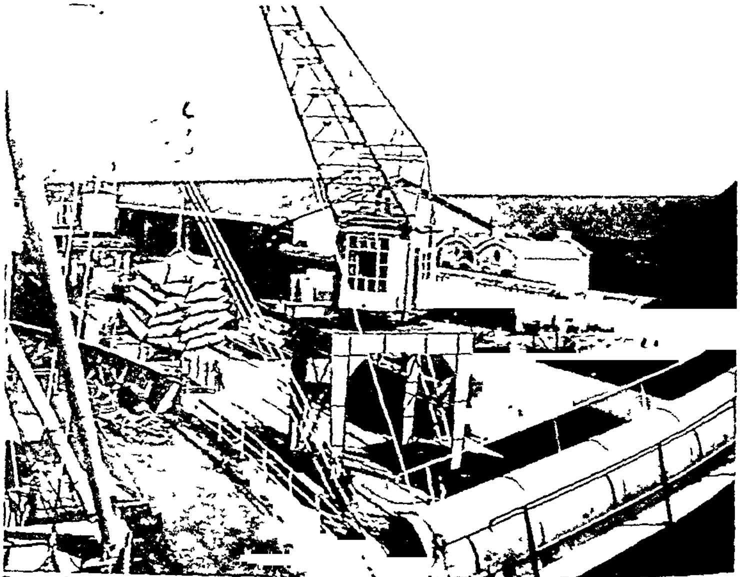
Many Varieties of Coffee

Though there are many species of coffee, most of the trees of the world belong to *Coffea arabica*, or Arabian coffee. *Coffea liberica* and *Coffea robusta* are also grown on a small scale. Coffee beans, even of the same species, vary widely in size, shape, color, and taste These differences are due to the altitude, climate, and soil in which they are grown, and somewhat to the age of the tree. Among important varieties imported into the United States are the Colombian *Bogota* and *Bucaramanga*. The *Guatemalas* of Central America depend for quality on altitude. The desirable higher-grown beans are for the most part exported to Europe. *Costa Ricas* go to England, and *Nicaraguans* and *Salvadores* are used by home and European markets *Javas*, so valuable formerly, were destroyed by a pest. *Sumatras* of highest quality are identical with old "government" Javas; they are large beans, yellow to brown, very rich and thick. *Mexicans*, medium to large bean, green to waxy green, are highly flavored. *Mocha* is small, poor looking, very sharp and pungent. *Abyssinians* or *Harars*, similar to Mochas, are often used as Mochas in blending. *Rios* (Brazil) are green to yellow, low grade, rank flavored. *Santos* (Brazil) one of the most popular coffees, are small to large, green to yellow, sweet and mild in flavor; some approach Rios in character. *Venezuelas* or *Maracaibos*, green to yellow, range from thin to very strong in the cup. *Hawaiians*, *Haitis*, *Porto Ricos*, and *San Domingos* are grown chiefly for home use.

COKE. The hard, brittle, porous residue left when coal is heated in a closed oven, is called coke. It has a steel-gray glint, and rings with a metallic sound when struck. Coke, being mostly carbon, is clean fuel, burning with an intense heat without smoke. For these reasons it is a good fuel for household fires, as well as for smelting ores, especially iron. Coke has become of great importance in the manufacture of synthetic ammonia by pressure methods, only air and water being mixed with the coke.

In the production of coke the coal is screened, sorted by size, and placed in coke ovens—all by machinery. In "beehive" ovens, named for their shape, all the vapors and gas are wasted, and the coke has only 60 to 65 per cent of the heating value of the coal consumed. About 90 per cent of American coke is made in "by-product" ovens, in which gas, tar, ammonia, and oils are salvaged. As many as 107 million tons of coal a year have been consumed in producing about $74\frac{1}{2}$ million tons of coke. Some of this coke is produced by manufacturers of cooking and illuminating gas. The steel industry uses more than 80 per cent of the coke produced; only about 5 per cent is burned to heat residences. Miscellaneous industrial uses consume the remainder.

THE WORLD'S GREATEST COFFEE SHIPPING PORT



Santos is the port through which the huge plantations of São Paulo send their coffee to the markets of the world. Brought here by a railroad network said to be the best run and best paying in South America, bags of coffee are stowed in the holds of waiting vessels at the rate of thousands an hour, either by cranes, or through chutes, like the one at the right. The town, which is on an island only a few feet above sea level, has passed Rio de Janeiro in the amount of its exports and is now the world's greatest coffee port.

Petroleum coke, obtained as a by-product in gasoline refining, is the purest form of industrial carbon available in large quantities. It is used for fuel, for making electric light carbons and electrodes in metal refining furnaces, as a reducing agent in lead and zinc smelting, and in the manufacture of paints.

COLBERT (*kôl-bêr'*), **JEAN BAPTISTE** (1619–1683). To Colbert, her greatest financial statesman, France still looks back with gratitude for his efforts to correct abuses which eventually led to the French Revolution. When he was called by Louis XIV to take charge of the finances of the country, he brought to his task an experience gained by his work for Cardinal Mazarin He had brought order out of chaos in the financial affairs of that statesman, and for his services had been recommended to the king. According to report Mazarin on his death-bed had said to Louis XIV: "I owe you everything, but I pay my debt to your majesty by giving you Colbert." Colbert fully justified this recommendation.

When he took charge of the treasury in 1664, the expenses of the government were each year exceeding its income. Within a year he was able to restore the balance, and even increase the income several million dollars above expenses. Best of all, he did this with-

out increasing the burden of taxation. He discovered that officials were stealing great sums from the revenues. These men were arrested and forced to give up their ill-gotten gains, and a new system of bookkeeping was introduced to check such abuses.

Colbert also encouraged manufacturing, both by establishing new industries and by seeing that the older ones produced high quality goods which would sell readily in foreign markets. Roads were improved and canals built, so that commerce might be aided. And finally, science and learning were encouraged by the establishment of the French Academy of Sciences, the building of an observatory, and the support of a periodical magazine, which is still published, devoted to the reviews of new books.

But Colbert could not curb the military ambitions of the extravagant king. Before his death he was hated by his countrymen, because he had been compelled to increase taxes in order to meet the expenses of Louis XIV's reckless wars and the enormous cost of the vast new palace at Versailles. When Colbert died he felt that his work had been in vain and that France was on the verge of ruin.

COLD STORAGE. The storage of food in seasons of plenty has long been practiced. However, it was not until mechanical methods of refrigeration were adapted to commercial use that large stores could be kept successfully for an extended length of time (*see* Refrigeration). The cold storage industry then quickly developed and grew until it became one of the major industries in the distribution of food.

It enables people who live in cities and towns, whether near or far from sources of supply, to have a fresh and varied diet all the year round. Refrigerator trucks, cars, and ships bring fresh fruits, meats, and other perishable foods from all over the world to terminal warehouses where they are stored under just the right conditions of cold and humidity to keep them fresh until grocers and other dealers need them.

In this way immense supplies of food are held from seasons of surplus production until seasons of scant production. Producers profit from longer marketing periods, increased demand, and the higher prices in seasons of smaller production; and consumers benefit from larger supplies and lower prices during seasons of least production. In the United States both federal and state laws regulate the length of time that foods may be kept in cold storage.

An outstanding recent development in the field of cold storage is the refrigerated locker plant and the home freezer where families can store food supplies that they have grown at home or purchased wholesale. Local products are thus made available over a longer period. The lockers are rented, and small charges are made for various additional services. These include butchering, chilling, cutting, grinding, curing, and smoking meat, dressing, drawing, and chilling poultry, wrapping and quick freezing these products as well as fruits and vegetables. Most of these plants are privately owned, but some are co-operatives.

COLERIDGE, SAMUEL TAYLOR (1772–1834). "Stop, you young thief!" An angry gentleman in a crowded London street was storming at a pale innocent-looking little lad, whose bare head, long blue coat, and yellow stockings marked him as a pupil of Christ's Hospital, the famous charity school. The boy's outstretched arms fell and his dreamy eyes flashed with a strange light. "Ah," he sighed, as if rudely awakened out of a delicious dream, "I thought I was Leander swimming the Hellespont. I did not mean to touch your pocket, sir."

The little bluecoat was Samuel Taylor Coleridge, and the result of this strange incident was that the old gentleman bought for him a subscription to a circulating library. So the little dreamer went on reading and acting out what he had read, and living in his own world of strange and beautiful fancies. Back in Devonshire in western England—before his father died and he was sent to school in the great city—he used to roam about the fields near his native village of Ottery St. Mary and slash off the tops of weeds as he went, imagining himself St. George slaying the Dragon. At the age of five, when most children are just beginning to spell out their first picture-books, he had already read the Bible, 'The Arabian Nights', and 'Robinson Crusoe'.

At Christ's Hospital he was a brilliant student, and at Cambridge University, which he entered at the age of 18, he won several prizes for scholarship. But he got into debt, ran away to London, and enlisted in the army under an assumed name. After a few months his friends secured his discharge and he returned to the university, but he left it later without obtaining his degree.

During these early years Coleridge became fired with the ideals of the French Revolution. With his friend Robert Southey he planned to go to America and found a "pantisocracy" or ideal commonwealth where farming and literature were to be combined, and no one was to work more than two hours a day. As a start they married two sisters, and then found they had no money to go further with the project.

Coleridge's natural disposition to day-dreaming, increased by the use of opium which he started taking to relieve the pains of neuralgia, was the weakness that wrecked his life and made his work a mere fragment of what it might have been. Indeed, had it not been for the help of friends, he could not have got along at all. On the other hand it is to this same imaginative power that we owe his unsurpassed dream poems—'The Rime of the Ancient Mariner', 'Christabel', and 'Kubla Khan'—which take us into the world of the supernatural where shines "the light that never was on land or sea."

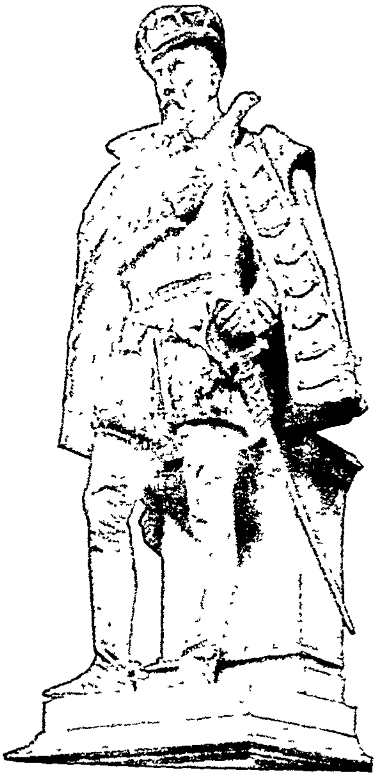
Among Coleridge's other intimate friends were Charles Lamb the essayist and the poet Wordsworth. On account of their residence in the beautiful northern lake district and the similarity of the poetical ideals they expressed, Coleridge, Wordsworth, and Southey were known as the "Lake Poets."

In spite of his frailties, the personal influence of Coleridge was very great, and in his last years he was visited by many noted men who listened spellbound to his marvelous talk. "He is the only wonderful man I ever met," said Wordsworth. "He talked on forever," said Hazlitt, "and you wished him to talk on forever." Carlyle called him "a king of men" in spite of his failures; and Lamb said humorously that he was "an archangel a little damaged."

Today it is for the few great poems written in his earlier years that Coleridge is chiefly remembered. Of his poetry it has been well said, "All that he did excellently might be bound up in 20 pages, but it should be bound in pure gold."

Though we think of Coleridge chiefly as a poet, he wrote more prose than poetry. His 'Biographia Literaria' (1817) gives a profound analysis of the nature of poetry and the principles of criticism. His 'Lectures on Shakespeare' (1849) show that he was one of the greatest of Shakespearean critics. 'Aids to Reflection' (1825) is the most famous of his many philosophical and religious works.

COLIGNY (*kō-lē-nyē'*), GASPARD DE (1519–1572). In the midst of the political intrigue which marked the religious wars in France during the last half of the 16th century, stands out the figure of Gaspard de Coligny, Admiral of France. While so many of the leaders of both parties—Catholics and Huguenots alike—were using the bitter spirit of religious controversy for their personal advantage, Admiral Coligny, head of the Protestant cause in France, won the respect of both sides by his unselfish devotion to what he believed were the true interests of his native land.



GASPARD DE COLIGNY
Huguenot leader of France

His straightforward policies were destined to cost him his life. Born of a noble family in Chatillon-sur-Loing, two years after Luther began his Reformation, Coligny from his youth had a brilliant military career which won for him the title of admiral in 1552. Through the influence of his brother, Francis d'Andelot, he became a Huguenot, exchanging letters with Calvin and using his power to protect the members of the new faith.

After the tragic death of King Henry II in a tournament in 1559, Coligny placed himself with the Prince of Condé in the forefront of the Huguenot party, and demanded religious toleration from the government. Despite his efforts to obtain a peaceful settlement of the religious troubles, civil war broke out; and after Condé had been killed at the battle of Jarnac, in 1569, Coligny was left chief leader of the Protestant armies. After gaining a victory at Arnay-le-Duc, he brought about a truce and returned to the court, where he rapidly gained the favor of the young king, Charles IX.

Catherine de Medici, the queen mother, saw in the friendship between Coligny and her son a menace to her ambitions. This sinister woman wanted to keep in her own hands the power she had wielded ever since King Henry's death, and Coligny, with his wise powerful counsel, stood in her way.

On Aug. 22, 1572, Coligny was wounded by the shot of an assassin, hired by Catherine and members of the Guise family, leaders of the court intrigue. King Charles at first swore to avenge the attempt on Coligny's life, but the next day Catherine and her favorites so worked upon the fears and prejudices of the young king that he consented to Coligny's death, crying in his desperate mood: "If you must kill him, then let all the Huguenots in France be killed, so none may be left to reproach me."

Catherine asked nothing more. Most of the leading Huguenots of France were even then in Paris, drawn there by the wedding a week before of their leader, King Henry of Navarre (later Henry IV of France), with the king's sister. Secret plans were laid at once, and on the night of August 24, the feast of St. Bartholomew, at a given signal the massacre of the Huguenots began.

Coligny was among the first to die. The wounded man was attacked in his house by a group led by Duke Henry of Guise. A German named Besme plunged a sword through his breast and threw his body out the window. Before St. Bartholomew's terrible night had passed, thousands of Huguenots had shared the fate of their leader. The massacre spread to other parts of France, lasting into the month of September. Though estimates differ as to the total number of victims, it is generally believed that more than 20,000 were killed before the fanatical fury had abated. It was reported that the Pope had caused a *Te Deum* to be sung in St. Peter's in honor of the event, but this is not historically true.

Coligny sent three unsuccessful colonies of Huguenots to the New World—the first in 1552 to Brazil; the second to South Carolina, which first settled Port Royal, in 1562; and the third to Florida, where a promising settlement was made at Fort Caroline, on the St. Johns River, in 1564. This, however, was exterminated—"not as Frenchmen, but as heretics"—by a Spanish expedition the next year.

COLLEGE. In current American usage the term "college" usually means an institution of higher education, giving instruction of a general rather than a professional character, where, after a regular course of study, the degree of Bachelor of Arts, or some equivalent degree, is granted Professional schools admitting undergraduates are also called colleges, as are the normal schools or teachers colleges But a typical college gives mainly a broad or "liberal" education

The American college has no exact counterpart in the educational systems of Europe or Great Britain Its scope is somewhat equivalent to the upper division of the French *lycée* or German *gymnasium* plus the lower division of the continental universities

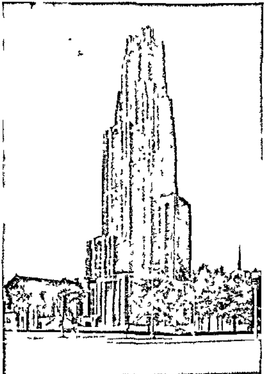
The ordinary college course covers four years The first year is called freshman; the second, sophomore; the third, junior, and the fourth, senior These same names are also applied to corresponding classes and to individual students At some colleges the school year is divided into two parts of 18 weeks each, called semesters, at other colleges, into four parts of about 12 weeks each, including a summer session, called quarters or terms.

Junior Colleges

The junior college is an institution which gives a two-year course beyond the standard of the high school. In some cases the curriculum is preparatory to further college work, in others it may be an independent unit suited for high-school graduates who desire to extend their education without taking a full course of four years

Many small colleges whose facilities were too inadequate for a four-year course have been transformed into junior colleges, others have been set up in connection with high schools, and even some universities have developed separate units of junior grade The junior college movement was inspired in part by the need of solving the problem of overcrowded universities It meets the demands of many young people, who desire some higher education but are not seeking a degree, and offers others an opportunity of beginning their college career on a more economical scale without leaving their home district

THE "CATHEDRAL OF LEARNING"



Many city educational institutions located where land for expansion is unavailable or too costly, are going "up in the air," as the University of Pittsburgh is doing here

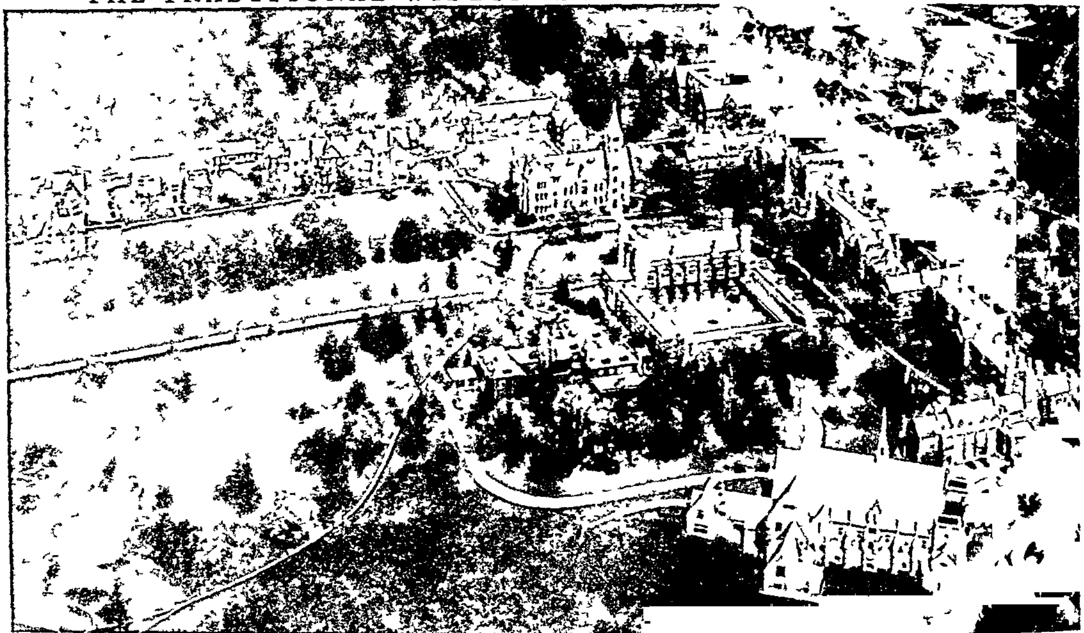
The curriculum of the early American college emphasized classical and mathematical studies Its training prepared one chiefly for the ministry or scholarly pursuits Courses in "natural history" and "natural philosophy," introduced early in the 19th century, were first incorporated as required subjects Modern languages and social and economic subjects were also added During the middle of the 19th century the importance of allowing the student some freedom of choice began to be recognized and was strongly advocated at Union and Brown The "elective system" later became a feature of practically all colleges, chiefly through the influence of the late President Eliot of Harvard University

There are still a few colleges which offer prescribed studies only in science, literature, and arts on the principle that a cultural background is essential to a well-educated person and prepares him to do better in whatever work he will later elect In the strictly vocational institution, on the other hand, the student may follow his interests virtually from the very beginning of his college career A third type of college, the most numerous, gives prescribed general courses for the first two years and prevocational elective courses during the junior and senior years

Every college sets up certain requirements to be met by students seeking admission Sometimes all that is required is the completion of a four-year course in a public high school or in some other accredited secondary school Other colleges state just what studies students must have pursued during their high-school course Some colleges require, in addition to graduation from an accredited secondary school, an examination in certain subjects Some also employ psychological tests (*see* Intelligence Tests), and some accept only candidates ranking in the upper half, or even higher, in their class in secondary school

The accrediting or classifying of colleges is carried out by various national or regional associations, such as the American Association of Junior Colleges, the North Central Association of Colleges and Secondary

THE TRADITIONAL WIDESPREAD SETTING OF A COLLEGE



Contrasting with the "vertical" college shown on a previous page is this widespread group of buildings of Bryn Mawr College for women at Bryn Mawr, near Philadelphia The charming open space, called the "campus," from the Latin for "field," is typical of most colleges, and is made possible because either the college is located where land values are low, obtained its site many years ago, when values were low, or obtained the land by public grant In fact, this open setting is so interwoven with American college life and tradition that college activities outside of studies are called "campus life."

Schools, or similar associations for the Southern states, New England states. To be approved or accredited, the college must have satisfactory entrance and graduation requirements, a sound and scholarly curriculum, a well-trained faculty of sufficient size in relation to the number of students, and buildings, equipment, library, and annual income adequate for an efficient educational program. (*See also* Education; School; Universities and Colleges)

Since the term "college" literally means simply a partnership or fraternity, from the Latin noun *collegium*, it may have somewhat general uses, such as electoral college, college of cardinals, and college of justice. For several hundred years after about 1450, the term was often used for merely any group of persons. Thus Shakespeare in 'Much Ado About Nothing' wrote "A college of wit-crackers . . ."

In England and Ireland, the name is reserved for separate, incorporated, self-governing educational institutions, which together form a university.

Many American institutions of learning, in the course of their development, have added professional courses given in separate departments or "schools" (for example, engineering, law, medicine, and dentistry); the original, or "founder's" college, which had a classical curriculum, retains its name often as the "College of Liberal Arts." A few American colleges have professional schools, but usually a college and the added schools form a university.

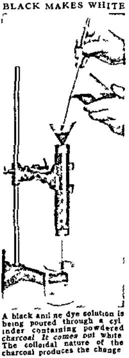
COLLO'DION. If you ever applied liquid "new skin" over a scratch or cut, you made use of one form of collodion Collodion is obtained by treating cellulose from cotton with nitric and sulphuric acid, then dissolving the resulting nitrocellulose in a mixture of ether and alcohol In the past, collodion was widely used for photographic film or to form the chemically treated film on glass photographic plates, but less inflammable cellulose products are tending to replace it (*see* Cellulose). Its flexibility and the degree to which it contracts are fixed by varying the portions of the alcohol and ether mixture, or by mixing in Canada balsam and castor oil. The product obtained with this mixture is not ideal for surgical use, even though it is highly flexible, since it does not contract over the wound to keep the edges drawn together and sealed

COLLOIDS. Salt and white of egg are familiar examples of two extremely different sorts of things Salt is a crystalline material, with little shining faces on its particles which show the regular way that the atoms inside each crystal are arranged (*see* Crystals) White of egg is one of the class of substances that scientists call colloids, which means merely that they are like glue. Glue is made of gelatin, which is one of these colloids. Another is starch paste. Emulsions like those used in medicine belong to the colloid group Rubber and chewing gum are also partly colloidal. Even living matter or protoplasm is a colloid (*see* Protoplasm) There are many other colloidal materials, so that scientists have developed during the last 30 years or so an important branch of science called colloid chemistry, which has wide industrial application, as well as being important to physiological science.

The essential thing about all colloids is that they consist of tiny particles of one substance scattered through another substance An emulsion of oil in water, for example, consists of a vast number of tiny oil droplets scattered through water Stiff salad dressings made by beating oil into a watery mixture of egg with vinegar or lemon juice also are colloids If you look at a thin film of this mixture under a powerful microscope you will see that it too consists of a *multitude of tiny oil droplets separated by a network* of watery films like the wax of a honeycomb

The fine particles in a colloid are called its *dispersed phase*, the substance in which the particles are scattered is the *dispersion medium* Colloids may be classified as solid, liquid, or gaseous In most colloids the medium is liquid If the dispersed particles are also liquid, the mixture is called an *emulsion colloid* or an *emulsoid* Milk and cream are emulsion colloids containing droplets of liquid butter *fat scattered in a watery* medium

BLACK MAKES WHITE



A black aniline dye solution is being poured through a cylinder containing powdered charcoal *It comes out white* The colloidal nature of the charcoal produces the change

How "Sols" and "Gels" Differ

Liquid emulsions are generally called *sols*, stiffer ones are called *gels* The same colloid may change from the sol condition to the gel condition or back again, as a mixture of gelatin and water does when it stiffens to a gel on cooling or softens to a sol on heating Fruit jellies are emulsion colloids usually stiffened by a substance called pectin which is contained in many fruits Some colloids, such as white of egg may harden or lose their colloidal character altogether when heated or when *treated with* chemicals This is called *coagulation* Some forces or chemicals act on the other hand, to conserve or increase the dispersion of the particles in a colloid This is called *peptization*

If the dispersion medium of a colloid is liquid with dispersed solid particles the mixture is called a *suspension colloid* or a *suspensoid* Liquid India ink is such a colloid consisting of tiny particles of solid carbon (lampblack) suspended in a watery solution These also are called sols Particles of metallic gold suspended in water make a series of such sols having beautiful colors of red yellow, or blue, depending upon the average size of the gold particles Similar colloids containing silver are used in medicine as disinfectants The particles of *many such* metallic colloids are too small to be seen through ordinary microscopes but may be made visible by an optical instrument, called the ultramicroscope used to observe the light sent out sidewise from a brightly *illuminated colloidal particle* as dust motes become visible in a beam of sunlight

It is possible to make colloids consisting of gas particles in a liquid medium Foam and soap-suds are examples Colloids may consist, too, of liquid or solid particles in a gaseous medium, fog being an example of one type and smoke or dusty air of the other one A few colloids are known in which the dispersion medium is solid one being the suspension of gold particles in glass which makes one kind of ruby glass Bread may be regarded as a colloid of gas particles dispersed in a solid medium

Scientists believe that the many unusual physical *and chemical properties of colloids are due chiefly to* the fact that they possess large amounts of internal surface, between the dispersed particles and the dispersion medium It is for this reason that the force of surface tension (*see* Physics, Water) comes prominently into play This force acting in the thin watery films between the oil droplets is what makes salad dressings stiff It is the surface force also which enables thin films of soap to worm their way underneath dirt particles stuck to the skin and pry these loose so that they are washed away Similar forces control the spreading of paint on painted surfaces the process of flotation used to concentrate minerals (*see* Mines and Mining) and even the action of the substances used in cosmetics such as rouge to make the color stick to the skin

What "Adsorption" Means

Some finely divided powders, as for example diatomaceous earth, are able to take color out of liquids such as lubricating oil or vinegar if these liquids are filtered through the powder What happens is that the atoms of the colored substance in the liquid stick fast to the surfaces of the solid particles by an adhesion closely related to other surface forces This is called *adsorption* and is believed to be of importance in determining the properties of colloids Gas atoms may be adsorbed, that is why finely powdered charcoal in gas masks can remove poison gases from air breathed through these devices A granular material much used to adsorb colors or gases in this way *is called silica gel This is a colloidal* mixture of silica with water (*see* Silicon)

COLOGNE, GERMANY Its location on the busy Rhine River has brought both good and bad fortune to Cologne one of the oldest cities of Germany The ancient city stands on the easily traveled flat lands where the lower Rhine widens on its way to the sea A network of railroads fleets of river craft, and even some seagoing vessels make Cologne one of the greatest transportation centers in Europe

This hub position, however led to almost complete destruction of the city during the second World War The Allies smashed it with more than 160 mass air raids, dropping more than 50,000 tons of bombs and

following with artillery bombardment. Over two thirds of the city fell in ruins.

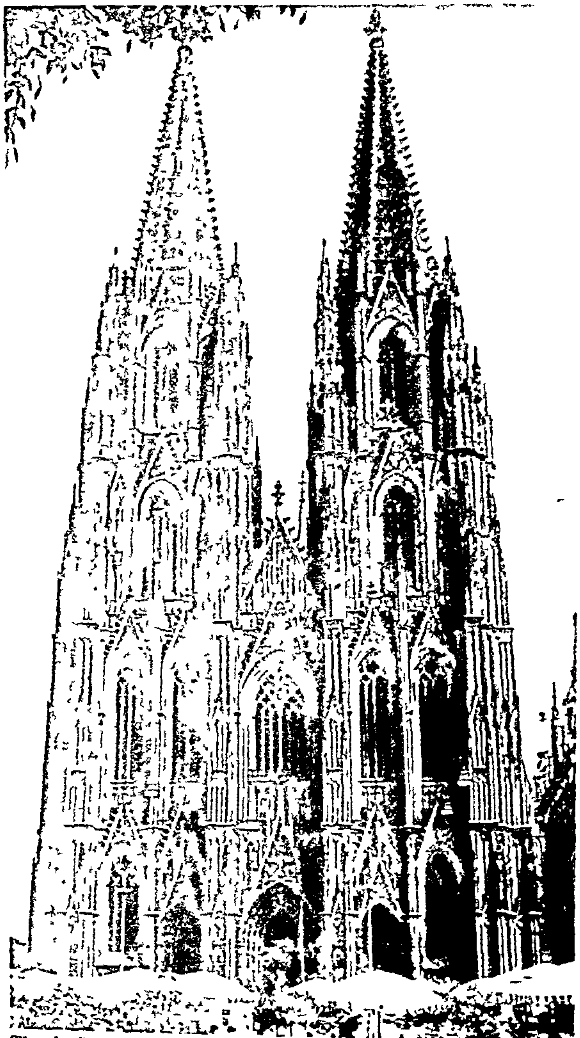
Cologne Rebuilds

Engineers at once set to restoring transportation facilities. They built new bridges to join the old section of the city with its industrial suburbs. One of the new spans is now called the Patton Bridge in honor of Gen. George S Patton, commander of the American Third Army in the second World War (*see* Patton).

Today more than a dozen railways link Cologne with the rest of Germany and with foreign countries. Trains clatter over the railway bridges at the rate of about one a minute.

Barges and lighters crowd the noisy river port. Grain and brown coal are the chief cargoes in the river trade Since the second World War Cologne has attracted many new industries. The most important is the manufacture of electrical goods. Another large industry is the production of chemicals, which includes making Eau de Cologne, the famed toilet water (*see* Perfumes). Engineering and shipbuilding are major industries. Cologne also produces automobiles, textiles, rubber, asbestos, clothing, machinery, and glassware.

COLOGNE'S "HYMN IN STONE"



This is Cologne's superb Gothic cathedral. The Allies deliberately spared it from bombing in the second World War. People so enjoy gazing up at its tall spires that they gather at tables at its base.

Great Gothic Cathedral of Cologne

The greatest treasure of Cologne is the city's magnificent Gothic cathedral, one of the most superb architectural achievements in all Europe. The Allies carefully spared it from bombing during the second World War. It did not suffer a direct hit, although many stones from the vault crashed down because of vibrations from buildings bombed nearby.

With its delicate soaring spires and stone lacework of slender pinnacles, the cathedral gives the effect of being a "hymn in stone." Work on the great church began about 1250 and was not completed until 1880. The heaviest of the cathedral's seven bells, "St. Peter's bell" (25 tons), was cast in 1923 to replace the "Emperor's bell," melted for arms in 1917

A gold reliquary in the cathedral is said to contain the bones of the "Three Kings of Cologne," the three Wise Men who came from the East to pay homage to the infant Christ Legend says the bones were brought from Palestine to Constantinople and from there to Milan Frederick Barbarossa seized them from there and sent them to the archbishop of Cologne

Romans Founded City

Invading Roman legions built a military outpost on the present site of Cologne in 38 B C Then in A D 50 it became a colony by order of Emperor Claudius. He called it Colonia Agrippina in honor of his wife who had been born there. Modern Germans call the city Köln

In the Middle Ages Cologne became a leader in the Hanseatic League an organization of merchant cities (*see* Hanseatic League). It dominated the region as a free imperial city, and its Rhine position gave it commercial advantage

Silks and spices from the Orient came over the Alps from the Mediterranean to be shipped down the Rhine to northern markets. To handle their trade by sea, the merchants of Cologne owned docks in London. Weights and measures used by Cologne became standard for the Rhine region and for even the Netherlands.

In the 17th century Cologne began to lose commercial prestige as new trade routes developed. The French took the city in 1794, and it went under the rule of Prussia in 1815. Development of the Ruhr Valley in the 19th century again made Cologne a great center of manufacturing and transportation.

In the first World War Cologne suffered almost no damage. From 1918 to 1926 it was occupied by British troops. At the outbreak of the second World War it was a mighty industrial city, the fourth largest in Germany, with a population of 772,000. Population (1950 census), 594,941.

At the FOOT *of the* PANAMA ISTHMUS

COLOMBIA Its commanding position on two oceans at the foot of the Isthmus of Panama gives Colombia an advantage in world trade over its South American neighbors The Panama Canal is about 300 miles from the ports of Barranquilla and Cartagena on the Caribbean and about 350 miles from Buenaventura on the Pacific side Lying wholly within the tropics its surface ribbed with gigantic mountain ranges Colombia has had formidable disadvantages to overcome Its capital Bogotá was once one of the most inaccessible cities in the world But this energetic and progressive nation was not to be discouraged by mountains swamps and jungles It simply flew over them for Colombia was the first Latin American country to adopt the airplane as a regular means of transportation With rich natural resources and an orderly government it is taking an increasingly important part in international affairs

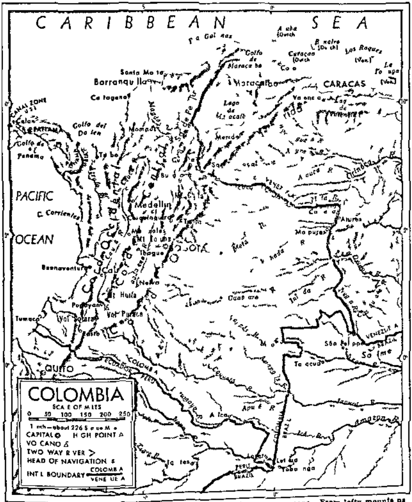
Colombia is the fourth largest country in South America with an area estimated at 439 828 square miles Venezuela and Brazil bound it on the east Peru and Ecuador on the south

Narrow plains fringe the coasts Behind them loom one after the other three great arms of the Andes rising the western third of the country from north to south For hundreds of miles east of these mountains stretch the level grasslands of the upper Orinoco basin and the jungles of the upper Amazon Valley This eastern two thirds of Colombia is so remote from civilization so hot and disease ridden that it is thinly populated and almost entirely undeveloped

Most of Colombia s people live on the high *plateaus* and in the valleys of the western mountains Here they find a healthful stimulating climate as well as fertile land for *farming*

Colombia's three parallel mountain ranges are called the *Cordillera Occidental, Central* and *Oriental* They come together in the south near the border of Ecuador The Sierra de Perijo on the Venezuela border is a spur of the Cordillera Oriental

Between the eastern and the central Cordillera lies a deep valley drained by the Magdalena River, the longest stream in the country It flows north for 1 000 miles, emptying into the Caribbean Sea near Barranquilla For about 700 miles from its mouth, it is navigable for large river steamers Between the central and the western ranges the Cauca River flows north for 600 miles to join the Magdalena Parts of this stream



Sitting astride the Isthmus of Panama Colombia looks out over two oceans From lofty mountains and cool plateaus on the ocean side the land slopes down to the steaming jungles of the interior Notice how the mountains divide into three parallel ranges with rivers between them

also are navigable. These two rivers are the chief arteries of trade and commerce, providing an outlet to the sea for the mountain-girt interior. Most of the railway lines are short links between river ports and upland cities. A new railway up the Magdalena was begun in 1953 with the aid of a World Bank loan. Numerous highways have been built, but many places are still reached by trails or cableways across canyons. Airlines supply fast transportation, reaching Bogotá from the Caribbean in 2½ hours. The river and rail trip takes from 4 to 15 days.

From Rain Forest to Cool Plateau

Vegetation on Colombian lowlands varies from tropical rain forest to the coarse grasses and scattered trees of the savanna, depending upon the rainfall. The arid eastern Guajira Peninsula has the cacti and thorn bushes of the desert. In the rain forests orchids grow wild and the trees swarm with insects, brilliantly colored birds, and monkeys. Though these forests produce rubber, tannin, tagua nuts, medicinal roots and herbs, and fine cabinet woods, transportation difficulties have hampered their development. Bananas are the chief crop of the coastal lowlands. Some cotton, sugar cane, and tropical fruits are raised.

At higher levels, in the mountain valleys and on terraced slopes, appear the small farms where tropical and semitropical crops are grown. More coffee is raised here than in any other country in the world except Brazil. It is the leading commercial crop and the chief export. Other crops include cotton, sugar, tobacco, cacao, and fique, a fiber similar to sisal.

Still higher, at 5,000 to 9,000 feet, are the cool, moist plateaus with fields of corn, wheat, barley, beans, and potatoes. One fourth of Colombia is grazing land, but the cattle are of inferior breeds.

In 1951 the census showed that Colombia had a population of 11,266,075. About three fourths of the people are farmers. Only about 2 per cent of the land is farmed, but new roads are gradually opening more. Most of the highland farmers are *mestizos*, of mixed white and Indian blood. The pure-blood Indians live mostly in the wilds east of the mountains. On the coasts are many Negroes, descendants of slaves brought in by the Spaniards. The total of white natives is variously estimated at from 10 to 35 per cent. The national language is Spanish; the religion, Roman Catholic.

Mining and Manufacturing

Petroleum is the most important of the many minerals. Near the Venezuela border in the north is the great Barco oil field. Other fields have been developed in the Magdalena Valley. Colombia is one of the world's largest producers of platinum. Gold, silver, and the world's finest emeralds have been mined here since the days of the Spanish conquest. Coal reserves are large but inaccessible.

Manufacturing began to grow after the government established a National Economic Council in 1935. The chief products include textiles, cigars, cigarettes, cement, flour, sugar, chocolate, beer, and leather goods. Many villages make clothing and hats by hand. Few manufactures are exported. Imports include machinery and metal products. Increased manufacturing was one of the chief goals of the economic commission set up in 1949 by Colombia and the International Bank for Reconstruction and Development (World Bank).

Bogotá, Famous Center of Culture

Bogotá, the capital and largest city (population, 645,255, 1951 census), lies on a plateau 8,660 feet high in the eastern Cordillera. Although it is only five degrees north of the equator, its altitude gives it a chill, damp climate. The city was founded in 1538 on the site of the ancient Chibcha Indian capital, named Bacatá. It still has the appearance of a Spanish city, with large plazas and narrow cobblestone streets overhung by balconies. Many old residences, however, are being demolished to make room for public buildings of extremely modernistic architecture.

To the capital come not only the political leaders of the country, but its students, artists, and writers. It has contributed generously to the literature of the continent (*see* Latin American Literature) and well earns the name "Athens of South America." Here are the National University, founded in 1572, a teachers college, medical school, academy of fine arts, a national observatory, a natural history museum, and a large botanical garden. Many newspapers and periodicals are published here and distributed over the country by air. Bogotá is also the trade and commercial center for a wide highland area.

Other Important Cities

Medellín (355,000), in the Central Cordillera above the Cauca Valley, is the second largest city and the chief manufacturing, mining, and coffee center. Barranquilla (279,000) is the chief seaport. Freight coming down the Magdalena River used to be transshipped here by rail to Puerto Colombia, 18 miles away, where it was loaded on ocean vessels. But in 1936 dredging operations opened the river mouth to ocean traffic. Cali (259,100), the distributing point for western Colombia, is connected by rail with the Pacific coast port of Buenaventura (23,000).

Cartagena (125,600) on the Caribbean was founded in 1533 and has changed but little since the days when it controlled the priceless commerce of the Spanish Main. In its spacious harbor, protected by massive fortified walls, assembled the galleons to be loaded with the treasure that came overland from Bolivia, Peru, and Ecuador. So rich a prize was repeatedly raided by pirates and buccaneers. Sir Francis Drake captured it in 1585. Today the city is the terminus of oil pipelines, with modern facilities for refining and shipping petroleum. The Dique Canal connects it with the Magdalena River.

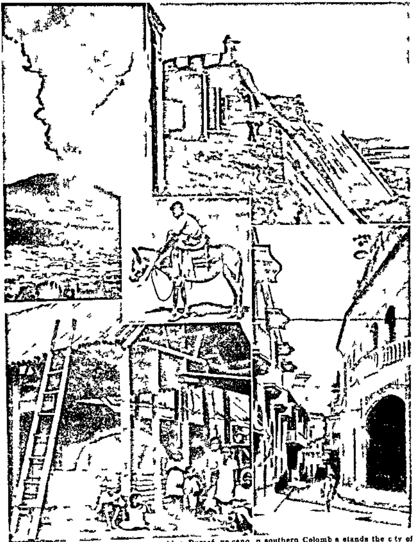
From Spanish Rule to Independence

The first white visitor to the coast of Colombia was Alonzo de Ojeda in 1499. Colonists soon arrived and after the founding of Bogotá in 1538, this region, under the name of New Granada, became the center of Spanish rule in the New World (*see* South America). Revolution against Spanish oppression began in 1810 and in 1821 Simón Bolívar, "the Liberator," formed

the Republic of Colombia including what are now Venezuela and Panama Soon after the province of Quito (Ecuador) was added But there were too many discordant elements and the unwieldy republic broke up in 1829 Colombia was then reconstructed as the Republic of New Granada and took its present name the Republic of Colombia in 1886 Frequent civil wars drained the strength of the country and disputes over boundaries with neighboring states kept affairs unsettled When in 1903 Panama seceded, ill feeling sprang up against the United States because it had aided the rebels The issue was settled by paying to Colombia $25 000 000 as indemnity for the Canal Zone

Colombia is a highly centralized democracy The president senators and representatives are popularly elected Provincial governors are appointed by the president Education is free but not compulsory Colombia has been hindered by slow development of its vast natural resources Aided by the World Bank it is trying to extend roads build factories and more schools and improve housing (For Reference-Outline and Bibliography *see* South America)

ON THE COASTS AND IN THE MOUNTAINS OF COLOMBIA



Upper left, at the foot of the ever smoking Puracé volcano in southern Colombia stands the city of Popayan famous center of learning founded in 1536 Upper right ruins of the ancient fortifications of Cartagena where Spaniards fought pirates in the 16th century Center a young native of Cartagena Lower left a dwelling in a village of the interior It is built entirely of bamboo The shed protects the outdoor oven Lower right an old street in Cartagena where ancient and modern buildings meet

COLONIES The tendency of peoples to establish colonies beyond the boundaries of their homeland has had an enormous influence on history It has distributed the knowledge and culture of the more enterprising portions of mankind It has led to the discovery and development of new lands and enriched the world with new resources It has helped to civilize backward races and has brought distant civilizations into touch with one another

It has also caused the bloodiest wars of conquest and the destruction of peoples who stood in the path of spreading empires It has excited bitter rivalries among those contending for colonies Into our time it continued to obstruct the path to world peace

Colonies in Ancient Days

Ancient Egypt Babylonia and other powerful states of antiquity conquered many foreign peoples ruled over them and collected tribute But this was not true colonization for there was no emigration of the victors into the conquered lands and the rule was purely military Among the earliest true colonizers in historic times were the Phoenicians These people

were not warlike or powerful in a military way. They were seafaring merchants, with headquarters at Sidon and Tyre on the Syrian coast, and the colonies they planted among the islands and along the shores of the Mediterranean were trading posts. One of these, Carthage, outgrew its parent cities and became an independent military power (*see* Carthage; Phoenicians).

The early Greek colonization of Asia Minor and the Aegean Islands was of still another character. It was not directed by any political or commercial plan at home. The colonists were simply emigrants of Greek stock, driven from Greece by enemies or poverty, and seeking new homes. They built cities and organized city-states, similar to those they had left behind. The ties of language and culture and trade remained strong among them, but with few exceptions they were politically independent and often at war with one another (*see* Greece).

The Romans introduced into the Western world the idea of dependent colonies, as we now understand them. With the expansion of their domain by conquest, colonization was methodically planned and carried out. First, the other Latin peoples were organized as colonial "allies," with some measure of self-rule. Later, as the population of Rome grew, groups of Roman citizens and particularly of old soldiers were offered land elsewhere. Each settlement usually began as a sort of city-camp established by the government, with magistrates to enforce the law among the settlers and a garrison to protect them in their trade and farming. Many of these colonies grew into great centers of wealth and culture. Those in the outlying parts of the empire—Syria, Africa, Spain, Gaul, Britain—served as headquarters for governing the barbarian peoples whose lands had been organized into provinces under Roman rule. (*See* Roman History.)

Colonies in Modern Times

For centuries after the Roman Empire dissolved, there was not in Europe any state sufficiently well protected at home to venture upon colonial enterprises. Between the 7th and the 15th centuries, the Arabs were the world's great colonizers (*see* Arabia and the Arabs). Then, as the nations of Europe took shape and sought wealth in trade, came the period of exploration. The discovery of North and South America and of the route around Africa to the East Indies started a period of colonial expansion which has since occupied a large share of world history. Portugal, Spain, France, the Netherlands, and England vied with one another in laying claim to trade and territory in the New World, in Asia, in Africa, and in the Pacific Ocean. Later, Germany, Belgium, Japan, and Italy entered the contest. The story of these colonial enterprises and rivalries and their outcome can be best traced through the articles on the continents and the countries concerned and through the study-outlines that accompany those articles. (*See also* America; American Colonies; East Indies.)

It is interesting to observe that nearly all the colonies founded in the New World later asserted themselves as independent nations. But the European nations held all their colonies in other continents until after the second World War, except for the short-lived Boer republics (*see* South Africa).

Motive for Seeking Colonies

Ambitious rulers have from time to time undertaken colonial conquests chiefly for glory and proof of power. But more practical motives lie behind most enterprises of this kind. The principal motives have been the following:

(1) To obtain control of the trade already existing between the territory seized and the rest of the world. (2) To increase the conquering nation's food supply from the fields of the conquered. (3) To get possession of precious metals and gems or of undeveloped raw materials, either for use in home industries or to sell to other people. (4) To secure a market among the people of the colony for the products of the conquerors. (5) To provide an outlet in the conquered land for the surplus population of the conquering nation. (6) To take advantage of the "cheap labor" of native populations. (7) To establish naval and military stations at points believed to be of strategic importance in protecting trade routes or defeating an enemy in future wars. (8) To recruit soldiers among the conquered peoples.

The Evolution of a Colony

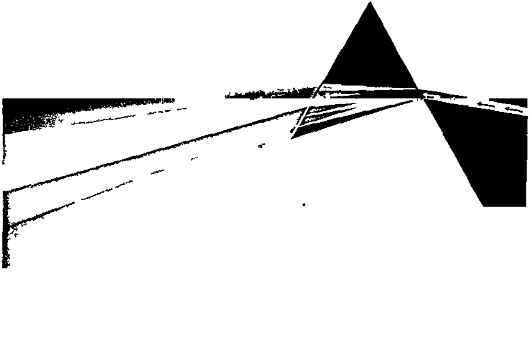
Colonies have not always been acquired by forceful seizure. Nations have sometimes extended their control over a region gradually. The first step is to enter into *exclusive trade treaties* with the native ruler or to obtain a small *concession* of land for business purposes. The second step is to establish a *protectorate* under which the invading nation guarantees to shield the native state from its enemies and consequently obtains control over its foreign relations. In the third and final step the invading nation consolidates its interests by taking control of internal affairs as well.

On the other hand, a colony may attain a great measure of self-rule after it has been established. This has happened in the case of the British *dominions*. Each dominion is virtually independent (autonomous), being bound to the other parts of the empire only through a sort of common agreement called "allegiance to the crown"—an agreement which gains its strength more from mutual traditions and interests than from law or force. The Irish Free State (Gaelic *Eire*) disavowed even this formal allegiance in 1937 (*see* Ireland). But the present British *colonies* are closely controlled. Final authority rests in officials accountable only to the British home government.

In popular usage all the foreign possessions of a nation are loosely grouped as its "colonies." But a colony is, strictly speaking, a settlement originally made by emigrants from the mother country. When the social and ordinary commercial life of a possession remains chiefly in the hands of the native population, it may more properly be called a *dependency*. Thus, Puerto Rico is often classed as a dependency of the United States.

Before the second World War two-fifths of the world's land area with a third of its population was occupied by colonies, dependencies, or dominions. After the war Italy and Japan lost their empires, and the spread of nationalism shook other colonial systems. Britain freed India in 1947 and Burma in 1948. Revolts forced France to grant autonomy to part of Indo-China, and Indonesian rebellions compelled the Netherlands to free the East Indies in 1949.

The SCIENCE *and* USE *of* COLOR



This picture gives the foundation of all color science. It shows what happens when a beam of sunlight passes through a glass prism. The beam divides into all the colors of the rainbow, proving that white light is made up of these colors. Only the chief colors are shown here: Red, Orange, Yellow, Green, Blue and Violet. In reality these blend gradually into one another, forming many intermediate hues, such as Red Orange, Blue Green and Blue Violet. The entire spread of colors is called the Spectrum. Of course, beams of light passing through glass or clear air are not visible from the side. But in these diagrams they are represented as visible to make their behavior clearer.

COLOR The world around us talks to us constantly in the language of color. Our eyes read this language just as our ears listen to the language of sound. Sometimes it brings us messages of beauty alone. Sometimes it gives us information.

Think of the many things that colors help us to recognize—animals and plants, foods, clothes, automobiles and houses, books and magazines, postage stamps and jewels. Soldiers, sailors, policemen and postmen are known by the colors of their uniforms, and colored flags mark the possessions of nations.

Colors are widely used for signals. All over the world red means danger and green safety. We know also that color greatly influences us in our buying. We have our favorite colors. Manufacturers of cloth, clothes, dishes, wallpaper, linoleum, furniture and automobiles must offer a wide choice of colors if they intend to please everyone.

Walk through the shopping center of a city and notice how colors emphasize store names and window displays. See how the neon signs cut through the other lights with their sharp red orange glare. Color is not always used to please our eyes. A harsh effect may attract more attention. Most colored advertisements in magazines as well as on billboards are planned chiefly to attract attention.

But the deepest influence that color can have upon us is through its power to create beauty. For thousands of years men have been trying to make beautiful things with stains, dyes and paints. They have decorated their homes and public buildings with colors. They have applied colored designs to the things they use, such as pottery, baskets, cloth and rugs. Above all they have expressed their feelings in painted pictures. To study the arts in which color has played a part, the reader should turn to the articles on Architecture, Fabrics, Interior Decoration, Pottery and Porcelain, Glass, Basket, Rugs and Carpets, Textiles and Painting.

Elementary Views of Color

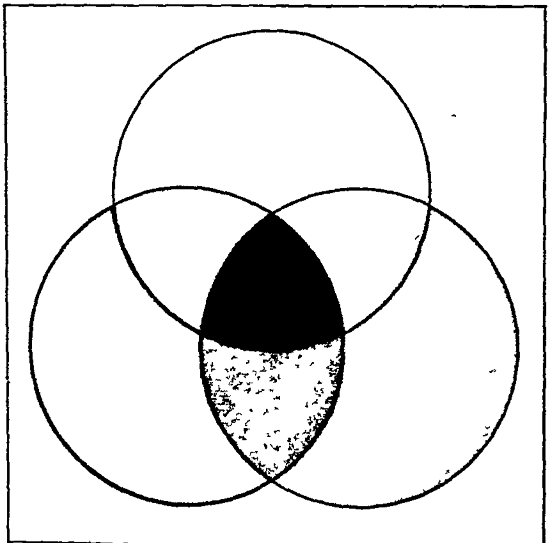
To understand the uses of color we must know something about color itself. Let us approach it first from the point of view of our common experience. What is color? We see it in two forms. We see colored

objects and we see colored *lights*. We know that the blue light from the sky is not the same as the blue paint with which an artist pictures the sky. And we know that the six "rainbow colors" in a paint box are not made of the same stuff as the real rainbow.

For convenience we can give the name *pigment colors* to any colors we see on a leaf, a fruit, or a rock, on paper or cloth, in a paint box or an ink bottle. And we can call the colors that come from the sun, from the sky, or from lamps the *colors of light*. We shall see later on that light is the real cause of all colors, but for the time being let us keep the two kinds of colors separate in our minds.

The picture on the preceding page shows what happens when a narrow beam of sunlight shines through a glass prism. Read the text under that picture. The reflection of the sun from the bevel-edge of a mirror will show the same division of light into the rainbow colors. You can see these colors also when a bright light shines on a soap bubble or when a film of oil or gasoline spreads on the surface of a pool of water. They are called the *spectrum colors*. But we use pigment colors much more than we do the colors of light. So we shall study those first.

THE TRADITIONAL PRIMARY COLORS



The outer parts of the three circles show the Blue, Yellow, and Red pigment colors, long recognized as "primaries" in art texts. Where two circles overlap, the "secondaries" are formed—Green, Orange, and Purple. The Black in the middle shows the mixture of all three primaries. On a later page we will see a more scientific division of primary and secondary colors.

Primaries, Secondaries, and Neutrals

We must begin with some of the words used to identify and describe colors. The diagram on this page shows us what are commonly known as the *primary* and *secondary* colors. A primary color is one that cannot be made from mixtures of other colors. A secondary color is one that can be made by a mixture of equal amounts of two primaries.

The diagram shows us also that a mixture of all three primary pigments makes black. When this mixture turns out a muddy gray or brown, as often happens, it is because the paints are either thin or of unequal color strength. Three strong well-matched paints will give a good black, and the fact that brilliant colors can cancel one another in this manner is an important point to remember. When colors do this we say that they "neutralize" each other. A *neutral* pigment is one that shows no "color" in the ordinary sense of the word. Black, white, and gray are neutrals.

Intermediate, Complementary, and Tertiary Colors

With the aid of our diagram, let us now study the results of other combinations. What happens if we mix a primary with a *neighboring* secondary—for example, blue with green? We can answer that by arithmetic. We know that the green is already half blue. When we add blue to it, the mixture will be two-thirds blue, and we get the *intermediate* color called blue-green. With yellow and green we get yellow-green. In the same way we can produce an intermediate color between each primary and secondary. Now suppose we mix a primary with the secondary *opposite* to it in our diagram — for example, red with green. What will that give us? We can read the answer in the diagram. It will give us black, for green contains blue and yellow, and we have already learned that red, blue, and yellow together make black. For the same reason yellow and purple will neutralize each other and make black. So will blue and orange.

Any two pigments that neutralize each other in a mixture are called a *complementary pair*, and each one is the *complementary* of the other. They need not give a solid black. They are complementaries also if they produce a truly neutral gray.

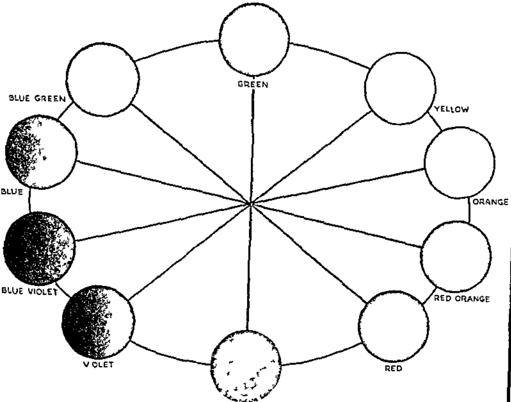
The last mixture we have to consider is that of two secondaries—for example, green and orange. Here, too, we have all three primaries represented, *but not in equal proportions*. For green is half blue and half yellow, while orange is half red and half yellow. So the mixture will be one-quarter blue, one-quarter red, but *one-half* yellow. It will therefore be only partly neutralized, and the surplus of yellow will give us a yellowish-brown of the kind commonly called dark olive. This and the other partly neutralized colors that can be obtained by mixtures of two secondaries are called *tertiary* colors.

A Convenient Color Ring

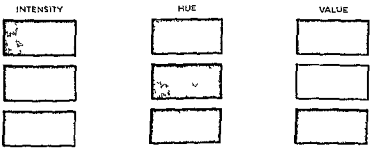
To mix colors from primaries is a useful way of studying color principles. But in practise, paints, dyes, and inks are rarely made in this way. They are prepared from chemicals that have in themselves the desired colors. One reason for this is that colors obtained by mixing pigments tend to lack brightness. Another reason is that violets and deep reds cannot be made from the common primaries.

A useful arrangement of ten colors is represented in the color ring on the opposite page. Of the ten, only the orange and blue-violet are mixtures of inks. Each of the others is printed with a separate ink. We can see there the difference between purple and violet,

A CHART OF IMPORTANT COLOR FACTS



In the color ring above the 10 fundamental colors most distinctly recognized by the eye are arranged in the order of the spectrum with purple joining the ends of the spectrum at the bottom. The pairs connected by crosslines are approximately complementary. At the left are the cool colors and at the right the warm colors, separated by the two colors of medium character, green and purple.



Here are examples of the three elements that define a color. The three colors in the middle differ in their fundamental character or *hue*. At the right we see a single hue (red orange) in three different *values*: first, normal; second, a tint, or high value produced by adding white; third, a shade, or low value, produced by adding black. At the left we see a single hue (blue) gradually lowered in intensity by the addition of gray but without any change in value (*see* text on next page).

the two colors most often confused. The ring also shows the important complementary pairs and indicates the colors that are called "warm" and "cool."

The Meaning of Hue, Value, and Intensity

When we try to describe a definite color in ordinary words, we have trouble making clear its exact appearance. A "red dress" may be anything from a bright crimson to a reddish-brown. A "blue necktie" may be a full rich blue or a light blue or a gray blue. For greater accuracy, color experts have distinguished three qualities that every color possesses—*hue, value,* and *intensity*. Sometimes these are spoken of as "the three dimensions of a color."

The *hue* of a color is its basic color identity. We define its hue when we call it violet, blue, green, yellow, orange, red, purple, or any intermediate such as blue-violet, blue-green, red-orange, red-purple, and so on. But names like brown, olive, pink, steel-blue are not names of hues, for these colors are only basic colors more or less neutralized. If we merely make a color lighter, darker, or grayer, we do not change its hue. To change one hue into another, we must alter its fundamental nature, as in making blue into green by adding yellow.

The *value* of a color means its lightness or darkness. Sometimes this is called its "brightness" as compared to white. We can readily see that the normal brightness of pure hues varies greatly. Yellow is brighter to the eye than blue; and orange is brighter than red. But that is not the important point here. Whatever may be the normal brightness of any hue, we can increase it by adding white or decrease it by adding black. This does not change the hue. In other words, adding black or white to a red-orange pigment, for instance, does not change its "red-orangeness." The lighter or higher value produced by adding white is called a "tint" of the color, and the darker or lower value produced by adding black is called a "shade." Occasionally we hear color values described as "tones."

Value, brightness, or tone is the only quality that distinguishes neutral pigments from one another. We have been mentioning white, black, and gray as if they were three distinct neutral elements. In reality they form a single "scale of values" with black at one end, ranging gradually through the dark grays, medium gray and light grays to pure white at the other end of the scale. This scale is a convenient measuring rod for the relative value or brightness of hues. For example, we can describe the value of a certain blue by saying that it matches medium gray.

The *intensity,* or *chroma,* of a color is its degree of purity, its freedom from neutralizing factors. A color entirely free from neutral elements is called "saturated." Our discussion of value showed that the value of a color is changed by adding white or black. This will, of course, also change the intensity. A pink made by adding white to red is brighter than the original red, but less intense because its proportion of pure color is smaller. But we can also change the intensity of a color *without changing its value.* We do this by mixing with it a gray of the same value or brightness as that of the color. The more gray we add, the lower becomes the intensity of the mixture, but the value remains constant.

Examples of differences in hue, value, and intensity will be found, pictured in color, on the preceding page. A method of color notation by which the value and intensity of any hue can be designated by numbers is known as the Munsell color system. It has been widely used for such purposes as ordering cloth or dyes of exact colors by telegraph or cable.

How Many Colors Are There?

With suitable instruments physicists are able to detect thousands of variations in the colors of the spectrum. But the human eye has no such power. If you examine the color ring on the preceding page and imagine from two to four intermediate hues between each of those pictured there, you will have in mind virtually the whole range of pure colors which the ordinary person can distinguish—about 40. The colors we see around us are mostly variations in value and intensity of the fundamental hues. It is rare indeed to find a color in its full strength. The greenest leaf looks grayish beside a sample of green paint. And the paint itself seems to lose some of its color when we use it, for the texture of wood and cloth and paper tends to throw shadows into the most brilliant pigments, dyes, and inks, or to thin them out with transparent whites or grays.

Is white a color? Is black a color? Is gray a color? These are catch questions. If we use the word "color" in the sense of "hue," then white, black, and gray are not colors. But the neutrals are colors in the broad sense of the word, as when we say that the colors of the American flag are red, white, and blue. Some authorities call the hues "chromatic colors" and the neutrals "achromatic colors."

Principles of Color Harmony

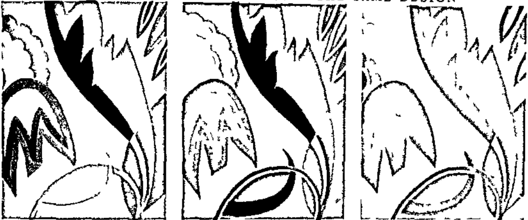
What colors go well together? Before answering that question, we must understand that there are no rules for creating beautiful color compositions. The subject and arrangement of pictures, the pattern of designs, their size, purpose, and place of display, all have an influence on the result. But a knowledge of the fundamentals of color harmony will save the art student from many a mistake. He should learn them and experiment with them, just as the student of music learns and practises with keys and chords. And all of us may apply them to combinations of color in clothing, in furnishings, and in home decorations.

There are two general laws of harmony: (1) The colors used must be related to one another in some definite way; (2) One color must dominate; equal competition between colors for our attention must be avoided.

Simple color harmonies usually fall into one of the following groups:

A Single Color with Neutrals: A real discord is impossible when a single color is used with white, black, or gray. But we must observe the rule against giving the color and the neutral equal prominence in the design. A warm color on the red side (*see* illustration of color ring) is generally

DISCORD AND HARMONY WITH THE SAME DESIGN



To get a true impression of each design in turn cover the other two At the left we see discord The chief fault is that the yellow green of the background and the magenta red of the middle figure are near complementary hues of equal intensity and nearly equal areas (*see text*) So also are the purple and the yellow in the upper left hand corner Furthermore there are various off shades of red and blue which resemble the central red and blue without matching them The middle panel is a harmony with strong contrasts The blue green background (complementary to the central red orange) has been lightened and grayed The other colors are tints and shades in related groups At the right is a harmony with soft contrasts No intense colors are used While some complementaries are present they are veiled In general almost any grayed colors will harmonize fairly well.

most effective with black or dark grays a cool color on the blue side is most effective with white or light grays

Tints, Shades and Intensities of the Same Hue With combinations of these also discord is impossible To be effective however the arrangement must bring out contrast between light and dark values or between different intensities A dominating rôle may be given to one of the values by letting it occupy a larger area

Harmony of Adjacent or Analogous Colors Colors that lie side by side in the color ring are easy to combine harmoniously because they have some one color in common Yellow for instance is the common factor of green yellow and orange Another set of adjacent or analogous colors is blue blue-green and green Blue and green alone might clash but with the blue-green to unite or blend them harmony can be established In selecting hues for one of these family groups it is safer not to go beyond the colors that lie within an angle of 90 degrees on the ring One of the colors should of course be dominant

Harmony of Complementaries If we use complementary pairs of colors at full intensity and in equal areas the effect is extremely unpleasant But if we partly neutralize one of them or give it a much smaller space than the other it enriches and strengthens its opposite and forms one of the best of harmonies We may use with a given color the hues on each side of its true complementary for example violet with orange and yellow green This is called a harmony with split complementaries

Triads Any three colors each of which is approximately the same distance apart from the other two on the color ring form what is called a triad The three primary pigments —blue yellow and red—form the most conspicuous triad of all Striking color effects can be obtained with a group of this kind but there is danger of crude and disagreeable contrasts To avoid this two of them may be partly *neutralized* or else given a blending veil with small additions of the third color or one may be neutralized and another confined to a small area leaving the third dominant.

Almost any combination of colors can be given the appearance of harmony if all the hues are sufficiently neutralized For many years this *method of avoiding* discord was the fashionable solution to all color problems that arose in selecting clothes furnishings and decorations What was called "good taste" was opposed to any vivid or strongly contrasting colors But modern taste is disposed to take advantage of the gay effect of bright colors and to study methods for using them harmoniously

Color Science for the More Advanced Student

We have been looking at color from the point of view of ordinary experience and to some extent from the point of view of the artist But the more advanced student will want to go more deeply into the scientific principles of color These principles particularly in recent years have been interpreted extended and applied in the service of industry—the manufacture of dyes and printing inks of materials for color photography and photoengraving of stage lighting equipment and advertising displays

Approaching the subject from this point of view we emphasize at the outset one fundamental fact *Color is a quality of light and does not exist apart from light* All our color sensations are caused by light rays entering our eyes Those light rays have to come originally from some glowing substance like the sun a flame or an electric lamp All other objects are seen by reflected light and the colors which they show exist in the light and not in the object

Let us be sure that we understand exactly what this means Men used to believe that light was something like a clear stream of water which picked up color from the objects it touched and so became stained or dyed as it were Most of us have some such idea We would say that the color of a red rose in some way "comes out of the rose" The fact is that the red rose does not *add* anything whatever to the light that falls upon it and which is in turn reflected to our eyes On the contrary, it *subtracts* something from that light This process of subtraction or *absorption* as it is

called, is the key to everything that follows. Let us see exactly how it works.

The picture of the spectrum that heads this article shows how sunlight is made up of a mixture of colored rays—violet, blue, green, yellow, orange, red, and hues intermediate between these six. These sunlight colors represent the "raw materials" from which all the other colors in the world are derived. No star, no flame, no artificial light sends out any color which is not also found in sunlight. Therefore, when we speak of the colors of light we mean those in sunlight or in the diffused sunlight we call daylight.

The article on Light explains that light consists of waves of energy, and that these waves vary in length, the shortest being the violet waves and the longest the red waves (*see also* Radiation; Spectrum). All the student needs to know here, however, is that various substances have a tendency, depending upon their chemical structure, to absorb certain wave-lengths of light and to reflect or transmit the others. The absorbed waves are turned into heat or some other form of energy. White substances reflect all wave-lengths of light equally and black substances absorb all or nearly all of them.

Experiments with Colored Lights

Let us make some simple experiments to illustrate absorption. We begin with a beam of white light from a high-power tungsten lamp (Fig. 1 on the opposite page). This beam contains the colors of the spectrum —violet, blue, green, yellow, orange, and red. We shine it through a piece of red-orange glass, and a beam of red-orange light comes out the other side. What has happened to our white light? We can answer best with the aid of the following diagram:

VIOLET	BLUE	GREEN	YELLOW	ORANGE	RED

The white area shows the part of the light that passed through the glass and gave us our red-orange beam—a mixture of yellow, orange, and red. The shaded area shows the part that was absorbed—a mixture of violet, blue, and green, represented in Fig. 1 by the blue-green square. We prove these facts in Fig. 2. We point a beam of blue-green light and a beam of red-orange light at a white surface. Where the two meet, we get white light again.

From our diagram, then, we can define red-orange as *white minus blue-green*. And conversely we can define blue-green as *white minus red-orange*. Modern color science uses "absorption diagrams" like the one above to define all colors. Here, for example, is a diagram for a brilliant yellow, which equals *white minus blue-violet:*

VIOLET	BLUE	GREEN	YELLOW	ORANGE	RED

Fig. 3 on the opposite page proves the correctness of this diagram by showing that yellow light plus blue-violet light equals white light.

An important question may arise at this point. Why is yellow represented as a mixture of green, yellow, orange, and red? Why not the yellow alone? Because virtually all the colors we ever see are mixtures of this kind, which usually have the appearance of the brightest *color in the mixture*. If a colored glass or a pigment absorbed from white light all the rays except the pure yellow, or the pure red-orange, or the pure blue-green, the results would be extremely feeble colors which could hardly be detected. That is why it is incorrect to say that a yellow object is one which reflects only yellow light, or a red object one which reflects only red light, as is often done in popular writing about colors. A color can be much more definitely determined by what it absorbs from white light than by what it reflects or transmits.

The absorption method of defining colors enables us also to figure out in advance the results of color combinations. For instance, if we compare our diagram for red-orange with our diagram for yellow, we see that yellow contains the same colors as red-orange, *with green added*. Therefore a red-orange light plus a green light ought to give us a yellow light. Fig. 4 in the plate of experiments shows that this is correct.

Let us now make an experiment first and see whether, from what we already know, we can draw a diagram of the result afterward. We shall combine a red-orange light and a blue-violet light (Fig. 5). We get the color called "magenta," a kind of purplish-red. *To make* a diagram of this color we must determine what part of white light is missing from it. From *our previous* diagrams we know that red-orange light contains yellow, orange, and red, and that blue-violet light is a blend of blue and violet. When we mix the two, therefore, we are uniting all the colors of white light, *except green*. So we can draw our diagram for magenta as follows:

VIOLET	BLUE	GREEN	YELLOW	ORANGE	RED

Fig. 6 illustrates how white light may be divided into *three* parts. First we send the light through a yellow glass. From our diagram for yellow and from Fig. 3, we know that this removes the blue-violet light. Then we send the yellow light through a blue-green glass. From our definition of blue-green, we know that this will remove red-orange. What have we left? Fig. 4 showed us that yellow is a combination of red-orange and green. Therefore, with the red-orange removed from the yellow light, green remains.

Experiments with Pigments

A pigment and a light of the same color send the same kind of rays to our eyes, and the same absorption diagram can be used for the light *transmitted* through a red-orange glass and for the light *reflected* from a spot of red-orange pigment. But when we mix pigments, we get very different results from those obtained when we mix lights. Compare, for example, the mixture of red-orange and green pigments in Fig. 7 with the mixture of red-orange and green lights in Fig. 4. A little reasoning will explain this difference.

FIG 1

FIG 2

FIG. 3

FIG 4

FIG 5

FIG 6

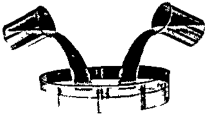


FIG 7

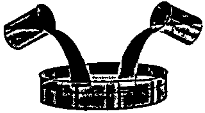


FIG 8

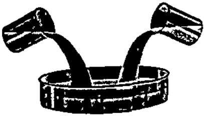


FIG 9

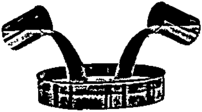


FIG 10

Some of the most important principles of color are illustrated by these experiments including the difference between the direct colors of light and the indirect colors of pigments. The text and diagrams on the opposite page explain the significance of each figure in turn.

Remember that when light is added to light, we are combining rays that are in themselves original and positive sources of color, and the result is a color closer to white light than either of the originals. To represent the results we add the white areas of our diagrams in this way:

RED-ORANGE LIGHT ——→ | V | B | G | Y | O | R |
plus GREEN LIGHT ——→ | V | B | G | Y | O | R |
equals YELLOW LIGHT ——→ | V | B | G | Y | O | R |

This illustrates the principle that *when we mix lights, the result is the sum of the colors that each light contains.* Now let us make diagrams of the pigment mixture:

RED-ORANGE PIGMENT ——→ | V | B | G | Y | O | R |
plus GREEN PIGMENT ——→ | V | B | G | Y | O | R |
equals BROWN PIGMENT ——→ | V | B | G | Y | O | R |

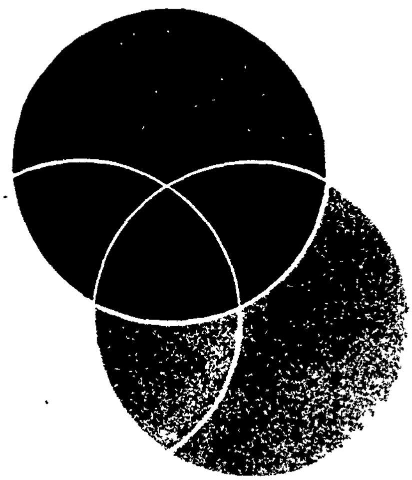
The active quality of a pigment is its absorbing power—not its reflecting power. And when we mix two pigments, we are adding the absorbing powers of each. *In the mixture, each pigment continues to subtract from white light the colors that it subtracted when it was alone.* Thus, our mixture of red-orange and green subtracts *all* the colors of the spectrum. The result, in theory, ought to be black. But no pigments absorb light perfectly. They tend to reflect a little of all the colors. In this case, however, each of the original pigments absorbs violet and blue. This gives us in the mixture a double absorption at the blue end, indicated in the diagram by solid black. The remainder, therefore, is the kind of darkened yellow we call brown.

Fig. 8 shows how yellow pigment (minus violet and blue) mixed with blue (minus orange and red) yields a yellowish-green. The common saying that "mixing blue and yellow makes green" would be more scientific if changed to "mixing blue and yellow *leaves* green."

When we mix yellow pigment with red pigment (Fig. 9) we get orange, the color that lies between yellow and red in the spectrum. The green light rays are absorbed by the red, and the blue rays are absorbed by both the yellow and the red.

If we take green and yellow out of white light, the blue and red rays that remain blend to give us purple.

THE PRIMARY COLORS OF LIGHT



The circles represent beams of the three primary colors of light—Blue-Violet, Yellow-Green, and Red-Orange—shining upon a white surface. Where two light beams overlap, we have the secondary colors of light—Blue-Green, Yellow, and Magenta. And where all three shine together, we have white light. But this order is exactly reversed if we consider these colors as pigments instead of as lights. The three inside colors become the pigment primaries and the three outside colors become the pigment secondaries (*see* text). When we read the diagram in that way it tells us, for example, that a mixture of Blue-Green and Magenta pigments will produce a Blue-Violet secondary.

Fig. 10 on the preceding page shows this taking place. The red pigment absorbs green light and the blue pigment absorbs yellow light.

The results of mixing pigments must not be confused with those obtained by experiments with so-called "color wheels." A color wheel is a disk upon which cards of various colors are placed side by side and which can be revolved rapidly to get the effect of the color combinations upon the eye. What the observer sees are mixtures of light rays reflected from the pigments on the cards. He does not get the effect of pigment mixtures.

Primary and Secondary Colors of Light

For many technical purposes—for example, color photography and photoengraving—white light is treated as if it were composed of three colors only—blue-violet, yellow-green, and red-orange. These are called the *primary colors of light*, and virtually all colors that reach our eyes, directly or by reflection, may be analyzed and described in terms of these three. They are illustrated by the diagram on this page. Examine this diagram, read the text under it, and note the following color relations:

Each primary and its opposite secondary—for example, blue-violet and yellow—form a complementary pair.

Each color in a pair is defined as white light from which the other color has been absorbed. For example, magenta is defined as white light minus yellow-green.

When combined in the form of lights, the two colors in a complementary pair produce white light. *But when combined as pigment colors, they produce black*, for in that case we are adding together their absorbing powers.

This leads us to the most important relation of all. The secondaries of light—namely, blue-green, yellow, and magenta—are regarded by color scientists as *the true primary pigment colors*, instead of the traditional blue, yellow, and red illustrated earlier in this article. And the primaries of light—blue-violet, yellow-green, and red-orange—become in turn the secondary pigment colors.

This color scheme unites in one scientifically related group, the colors of light and the pigment colors, and it has become the accepted classification in many industries. For instance, in color-photography and photoengraving, the pictures made by means of colored rays entering the camera lens must be reproduced in turn by means of dyes or printing inks. Therefore the relations between light rays and pigments must be very accurately determined. The illustration on the opposite page shows how yellow, magenta, and blue-green inks printed over one another reproduce the

STEPS IN PRINTING A PICTURE IN COLORS

FOUR PLATES ARE USED. AT THE TOP WE SEE EACH PLATE PRINTED SEPARATELY

1 The Yellow Plate

Actual printing begins below with an impression from the yellow ink plate

2 The Black Plate

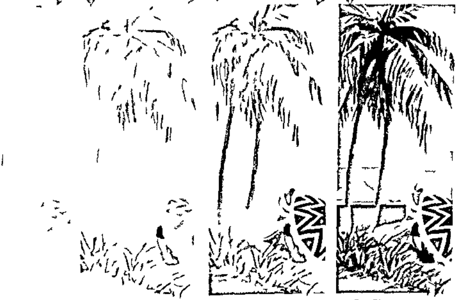
Next the black ink plate prints on top of the yellow producing this result

3 The Red Magenta Plate

The red ink plate now adds its part of the picture to the yellow black

4 The Blue Green Plate

Last the blue ink plate prints over yellow black red and the job is done



5 Yellow Plate Alone

6 Black on Yellow

7 Red on Black Yellow

8 The Finished Picture

To make the four printing plates the photoengraver photographs the artist's drawing four times One negative is made with a clear lens for the black and one each with gelatin filters colored blue violet yellow green and red-orange (the primary colors of light) The positive plates are then prepared like ordinary half tone engravings (see *Photoengraving*) Because the blue violet filter absorbs yellow its negative shows blank areas wherever yellow forms all or part of a color in the original drawing The positive printed through blank places in that negative is a record of those yellow areas and is printed in yellow ink The negative photographed through the green filter makes the magenta plate and the negative produced with the red orange filter makes the blue green plate All but the very darkest areas are etched out of the black plate

many different colors of a poster design, and the text under the illustration explains how the printing plates are prepared with the aid of blue-violet, yellow-green, and red-orange color filters—the true complementaries respectively of yellow, magenta, and blue-green. (*See also* Photoengraving, Photography.)

Like the color photographer and photoengraver, the theatrical scene painter and the costume designer are interested in the relations of colored lights and pigments. They must know how the pigment colors in their materials will look under the stage lights. Many of the amazing effects we see on the modern stage are simple applications of the principles we have been studying. For example, a figure appearing in magenta costume and mask against a black background can be made to disappear entirely by switching the lights from white to yellow-green. A yellow costume will change to a bright red under a magenta light. Scores of other color effects can be worked out by a study of the light-absorbing properties of pigments.

The Psychology of Color

Stage effects suggest another important aspect of color. We know that certain colors in themselves, apart from any question of discord or harmony, exercise an influence upon our emotions. Many of these are traced to the direct action of colors on the nerves of the eye. People in hospitals, for instance, rest more quietly and go to sleep more easily in rooms with blue walls than in rooms with green, yellow, or red walls. In general, red is an exciting color. That is perhaps why red is so widely used as a danger signal.

The power of colors to stir our feelings is also strikingly demonstrated by the famous *clavilux* or "color organ" invented by Thomas Wilfred, which has won popular success all over the world. The instrument, played by pressing keys, throws on a screen in a dark hall any desired succession or combination of colored lights. In skilful hands it creates moods and emotions similar to those induced by fine music.

Other psychological effects of color are directly related to optical principles. In the dark a red light will seem nearer to us than it really is, and a blue light will seem farther away. The eye adjusts its focus in a different way for the long-wave red rays and the short-wave blue rays. This may explain the impressions of artists who call the reds "advancing colors" and the blues "retreating colors."

After-Images Show Complementary Colors

One of the most interesting and important reactions of the eye to colors can be illustrated by a simple experiment. In the middle of a sheet of white paper make a red spot about an inch square. Hold this in front of your eyes in a strong light and look intently at the center of the spot for about 30 seconds. Now remove the paper with the red spot and look steadily at a sheet of white paper. Almost immediately you will see the image of a spot of the same size and shape as the red spot, *but its color will be blue-green.* This is called an *after-image*. It is nothing but a reaction of the eye nerves. They grow tired of the red sensation and set up in its place the one sensation which will neutralize it—namely, blue-green, the complementary of red. If you gaze at a blue-green spot, the after-image will be red; a violet spot will give a yellow after-image; an orange spot, a blue after-image. Each after-image is always the complementary of the other. For this reason, the psychologist defines a complementary pair of colors as *two colors either of which has the other for its after-image.* A white background is not necessary to the appearance of after-images. They can be seen against gray or black backgrounds, or even by simply closing the eyes.

By means of this experiment we can understand why complementary colors of equal prominence in a design cannot harmonize. The original colors and the after-images are in conflict and set up unpleasant vibrations of the optic nerve.

The experiment shows also why green trees often seem to cast purple shadows. In the neutral gray of the shadow the eye sees the after-image of the green. The famous "impressionist" painters of the 19th century were the first to depict deliberately in their paintings color reactions of this kind.

Psychologists have developed color theories based on eye reactions. These differ in some details from both the working principles of artists and the color science of physicists. Many psychologists distinguish, for example, *four primary color sensations*—blue, green, yellow, and red. They believe that we recognize all other colors through mixed sensations made up of various proportions of those four.

Colors as Symbols and as Social Factors

Color plays an interesting rôle in the history of customs. Crimson was the imperial color of the ancients, just as yellow is today the imperial color in the Far East. Among English-speaking people yellow often stands for deceit and cowardice, blue for wisdom and honesty, and red for courage. In the political field, red is used as the symbol of violence and revolt.

The great dye industries of the world continually try to develop new pigments to satisfy the popular taste for variety in color (*see* Dyes). Manufacturers of textiles vie with one another in introducing new shades in modern designs (*see* Textiles; Fabrics). Fashion makers and dress designers urge that colors should be made to express the personality of the wearer (*see* Dress). In a hundred directions we find people at work on color problems—scientific, industrial, and artistic. A knowledge of color fundamentals opens our eyes to many points of interest that we would otherwise miss entirely in this field.

Books about Color

Bond, Fred. Color—How to See and Use It (Camera Craft, 1954).

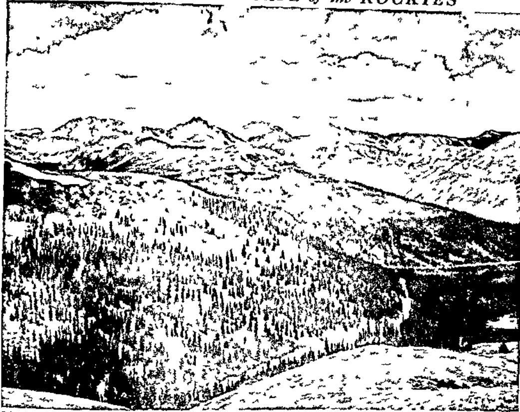
Bustanoby, J. H. Principles of Color and Color Mixing (McGraw, 1947).

Cheskin, Louis. Colors, What They Can Do for You (Liveright, 1947)

Evans, R. M. Introduction to Color (Wiley, 1948).

Luckiesh, Matthew. Color and Colors (Van Nostrand, 1938)

The TREASURE STATE of the ROCKIES



Colorado s mountains are a double source of wealth They hold a great store of mineral riches and attract millions of tourists who come to enjoy their magnificent scenery Loveland Pass across the Continental Divide near Dillon is an example of their beauty

COLORADO Gold and silver were the magnets which drew settlers to Colorado In 1858 gold was discovered in the plains near the present site of Denver On May 6 1859 John Gregory found rich gold deposits near what is now Central City

News of these d scoveries spread rapidly across the nation Thousands of fortune seekers headed toward the gold fields on foot with mules and in ox-drawn covered wagons On the wagons they wrote Pikes Peak or bust!' This was the first of several gold rushes which occurred as late as 1891 when silver as well as gold was found at Cripple Creek

After each gold rush many miners and farmers settled the region By 1861 the people of the mountain country obtained their first self government when Congress created the Territory of Colorado In 1876 a hundred years after the s gning of the Declaration of Independence Colorado became a state The timing gave it the nickname Centennial State '

The Highest State in the Union

With an average elevation of 6 800 feet above sea level, Colorado is the highest state in the Union This is because about half of its area l es within the Rocky Mountains These mountains have 52 peaks in Colorado rising more than 14 000 feet above sea level This is more than half of all the highest peaks in the United States and Alaska Even the lowest portion of the state east of the mountains lies about a mile above sea level The lowest passes across the moun tains lie much h gher and many passes have elevations of from 10 000 to 12 000 feet

These h gh elevations have had profound influence upon the development of the region and of the entire Far West The best routes for reaching the Pacific coast lie north and south of Colorado As a result few people settled in the state until the days of the gold rushes The difficult job of building railroads through the mountains also had to wait until the development of mines offered prospects of revenue sufficient to repay high construction costs

The Lay of the Land

Colorado is composed of three main geographic regions In the east the high plains of the Great Plains region ascend from the Kansas Nebraska border to the Front Range of the Rocky Mountains nearly half way across the state The mountains lie in a sprawl ing mass extending roughly from the northwest corner of the state to the south center and southwest

THE RUGGED MOUNTAINS AND HIGH PLAINS OF COLORADO

The Front Range of the Rocky Mountains runs north and south across the middle of Colorado, cutting the state in two. From it, high prairies slope down eastward to Kansas. Behind it to the west is the watershed of the nation, the Continental Divide (shown in white broken line). The mountains extend into parts of Wyoming, Utah, and New Mexico. In the southwest is the famous "four corners" where Colorado, Utah, Arizona, and New Mexico meet at right angles—the only such meeting of states in the nation.

In the west, the mountains descend to the high plateaus of the Basin and Plateau region.

In the Rocky Mountains is the Continental Divide, usually known as the Great Divide. It zigzags from north to south, west of the state's center. This divide separates the waters flowing to the Gulf of Mexico from those going to the Pacific Ocean. From it the South Platte and the Arkansas rivers flow east, others flow southeast, and the Rio Grande flows south and southeast. All drain through the Mississippi or directly into the Gulf of Mexico, and thus form part of the Atlantic coast drainage. West of the Divide, the land drains through the Colorado and its northern branch, the Green, to the Gulf of California and the Pacific. Some rivers of the Colorado system have cut deep canyons whose walls show magnificent red-brown hues. From these, the state received its name Colorado (Spanish for "reddish-colored").

Climate and Distribution of Population

The climate of the state varies greatly from one part to another, due mainly to elevation. In and near the mountains, the air is light, cool, and exhilarating, attracting tourists and health seekers. Throughout the state, the average summer temperature is about 65° F., and there are many sunny days. The average yearly rainfall is only 17 inches.

The state west of the Divide is lightly populated It has many small towns and few small cities. The plateaus are mostly desert except for strips of farm land, usually irrigated, along many of the rivers. The largest cities are along the Front Range, and on the irrigated lands of the eastern plains.

Natural Parks and Noted Scenic Areas

Lying near the Continental Divide are Colorado's great natural parks. These are huge plateaus, partly wooded but chiefly grasslands, and usually surrounded by mountains. The largest of these, San Luis, in the southern part of the state, has an area almost equal to that of Massachusetts.

Colorado is also noted for scenic centers. The largest of these is Rocky Mountain National Park, an area of lovely valleys, brooks, and lakes. It is rimmed by towering ranges and impressive peaks, conspicuous among them being Longs Peak. At the park's eastern limit is the village of Estes Park, once the home of Enos Mills, writer and naturalist.

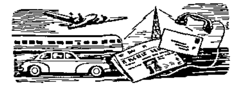
Continued on page 411

Colorado Fact Summary

COLORADO (Colo.) Spanish word meaning red or reddish-colored name was first applied to Colorado River and later to the state. **Nickname** Centennial State, admitted to Union 1876, 100 years after signing of Declaration of Independence. Sometimes called Switzerland of America because of its natural beauty. **Seal** Shield bears miner's pick and hammer surmounted by three mountains. Above is a band with words Union and Constitution entwined about Roman fasces. Crest shows symbolic all-seeing eye of God. **Motto** Nil Sine Numine (Nothing without the Deity). **Flag** For description and illustration *see* Flags. **Flower** Rocky Mountain Columbine. **Bird** Lark bunting. **Tree** Blue spruce. **Song** Where the Columbines Grow, words and music by Arthur J. Fynn.

THE GOVERNMENT

Capital Denver (since 1876). **Representation in Congress** Senate 2, House of Representatives 4. Electoral votes 6. **General Assembly** Senators 35, term 4 years; Representatives 65, term 2 years. Convenes first Wednesday after first Tuesday in January annually. No limit to regular or special sessions. **Constitution** Adopted 1876. Proposed amendment must be (a) passed by a two-thirds majority of both legislative houses or by initiative action of the people and (b) ratified by a majority voting on amendment. **Governor** Term 2 years. May succeed himself. **Other Executive Officers** Lieutenant governor, secretary of state, attorney general, treasurer, auditor, all elected, terms 2 years. **Judiciary** Supreme court, 7 justices elected at large, term 10 years. District courts—15, 32 judges elected, term 6 years. County courts—1 in each county, judges elected, term 4 years. **County** 63 counties, each governed by a board of 3 county commissioners, boards elected, term 4 years, officers elected, term 2 years. **Municipal** Mayor and council plan most common; some cities have commissioners or city managers. **Voting Qualifications** Age 21, residence in state 1 year, in county 90 days, in district 15 days.

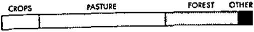


TRANSPORTATION AND COMMUNICATION

Transportation Railroads 4,200 miles. First railroad Denver to Cheyenne, Wyo., 1870. Rural roads 72,000 miles. Airports 105. **Communication** Periodicals 67. Newspapers 187. First newspaper *Rocky Mountain News*, Denver, 1859. Radio stations (AM and FM) 35; first station KLZ, Denver, licensed March 10, 1922. Television stations 6; first station KFEL, Denver, began operation on July 18, 1952. Telephones 516,000. Post offices 547.

THE PEOPLE AND THEIR LAND

Population (1950 census) 1,325,089 (rank among 48 states—34th); urban 62.7%, rural 37.3%. Density 12.8 persons per square mile (rank—39th state). **Extent** Area 104,247 square miles, including 325 square miles of water surface (7th state in size). **Elevation** Highest, Mount Elbert, 14,431 ft., near Twin Lakes; lowest, Arkansas R. near Kansas line, 3,350 ft. **Temperature** (°F.) Average—annual 45; winter 25°; spring 44; summer 65; fall 47°. Lowest recorded −60 (Taylor Park, Gunnison County, Feb. 1, 1951); highest recorded 118 (Bennett, July 11, 1888). **Precipitation** Average (inches)—annual 17; winter 3; spring 5; summer 5; fall 4. Varies from about 8 in southwest corner to about 30 in north central. **Natural Features** Rocky Mountains divide state through center. On east side land slopes gently through arid plains toward Kansas and Nebraska; on west, plateaus descend step by step to Utah border. Rivers of eastern slope: Arkansas, North Platte, South Platte, Republican, and Rio Grande. Rivers of western slope: Colorado, Gunnison, San Juan, White, and Yampa. **Land Use** Cropland 15%, nonforested pasture 50%, forest 29%, other (roads, parks, game refuges, wasteland, cities, etc.) 6%.



Natural Resources *Agricultural*: wide variety of fertile soils rich in minerals, mountain rivers, streams make extensive irrigation possible. *Industrial*—abundant coal supply, other minerals, and water power promote manufacturing; rich petroleum deposits. *Commercial*—climate and scenery attract vacationists.

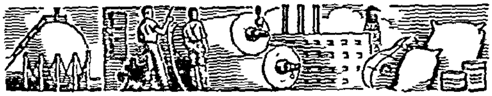
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations, 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Wholesale and retail trade	100,431	21.0
Agriculture, forestry, and fishery	72,467	15.2
Manufacturing	58,[illegible]79	12.2
Professional services (medical, legal, educational, etc.)	50,975	10.7
Transportation, communication, and other public utilities	45,00[illegible]	9.4
Construction	38,085	8.0
Personal services (hotel, domestic, laundering, etc.)	[illegible]9,6[illegible]5	6.2
Government	[illegible]6,58[illegible]	5.6
Finance, insurance, and real estate	16,947	3.6
Business and repair services	15,146	3.2
Mining	10,[illegible]54	2.2
Amusement, recreation, and related services	5,715	1.2
Workers not accounted for	7,086	1.5
Total employed	4[illegible]6,644	100.0

Colorado Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—34th)
Value added by manufacture* (1952), $397,464,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
FOOD AND KINDRED PRODUCTS .. Beet sugar; meat packing; bakery products; grain-mill products	$92,675,000	24
PRIMARY METAL INDUSTRIES..... Blast furnace, steel mill and iron and steel foundry products	37,395,000	20
MACHINERY (EXCEPT ELECTRICAL) Construction and mining machinery; special-industry machinery	22,550,000	28
PRINTING AND PUBLISHING..... . Newspapers; commercial printing	22,386,000	28
STONE, CLAY, AND GLASS PRODUCTS Structural clay products; concrete and plaster products	11,966,000	30
RUBBER PRODUCTS	.... †	..

*For explanation of value added by manufacture, see Census.
†Figure withheld by the Bureau of the Census.

B. Farm Products (Rank among states—18th)
Total cash income (1952), $607,666,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Cattle	463,709,000 lbs.	1	15
Wheat..........	35,996,000 bu.	2	10
Hay............	2,238,000 tons	3	19
Milk...........	480,000,000 qts.	4	32
Sheep and lambs.	104,233,000 lbs.	5	5
Potatoes........	17,313,000 bu.	6	9
Sugar beets......	1,882,000 tons	7	2
Corn...........	15,145,000 bu.	8	28

*Rank in dollar value †Rank in units produced

C. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $179,434,000
Rank among states—18th

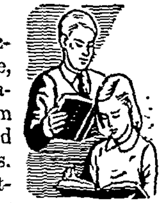
Minerals (1951)	Amount Produced	Value
Petroleum........	27,823,000 bbls.	$70,670,000
Molybdenum*.....	....	....
Coal............	4,103,000 tons	21,165,000
Zinc	56,000 tons	20,280,000
Lead............	30,000 tons	10,496,000
Sand and gravel...	6,917,000 tons	4,452,000

*Molybdenum ranks 2d in value; exact figure not available.

D. Trade

Trade (1948)	Sales	Rank among States
Wholesale.......	$1,659,829,000	29
Retail..........	1,257,095,000	31
Service.........	123,257,000	28

EDUCATION



Public Schools: Elementary, 1,268; secondary, 257. Compulsory school age, 8 through 16. State Board of Education elected; 5 members, one from each of 4 congressional districts, and one from state at large; 6-year terms. Commissioner of education appointed by State Board of Education; term, at pleasure of Board. County superintendents; 2-year terms. District boards of education elected; 3 to 5 members; 3- or 6-year terms.

Private and Parochial Schools: 112.

Colleges and Universities (accredited): Colleges, 10; junior colleges, 7. State-supported schools are Univ. of Colo., Boulder; Colo. School of Mines, Golden; Colo. Agriculture and Mechanical, Fort Collins; Colo. State College of Education, Greeley; Adams State College, Alamosa; Western State College, Gunnison; junior colleges (Lamar, Mesa at Grand Junction, Pueblo, Sterling, Trinidad, Fort Lewis A and M College at Hesperus, Colorado Woman's College, Denver.)

Special State Schools: State Home and Training School for Mental Defectives, Grand Junction and Ridge; Home for Dependent and Neglected Children, Denver; School for Deaf and Blind, Colorado Springs.

Libraries: City and town public libraries, 108; independent county libraries, 20. State Library, Dept. of Education, aids in developing library service; work headed by deputy state librarian. Noted special libraries: Bibliographical Center for Research, Rocky Mountain Region and State Historical Society, both at Denver.

Outstanding Museums: University of Colorado Museum, Boulder; Colorado Springs Fine Arts Center, Colorado Springs; Denver Museum of Natural History, Denver Art Museum, Colorado State Museum, all in Denver; Bent's Fort Museum, La Junta; State Museum, Fort Garland.

CORRECTIONAL AND PENAL INSTITUTIONS

Industrial School for Boys, Golden; Industrial School for Girls, Mt. Morrison; State Reformatory, Buena Vista; State Penitentiary, Canon City.

NATIONAL PARKS*

Mesa Verde—51,018 acres of canyons and mesa lands; well-preserved prehistoric cliff dwellings, pueblos, and Basket Maker relics; Cliff Palace most spectacular (42).

Rocky Mountain—254,736 acres lying on both sides of Continental Divide; majestic mountain range contains 65 peaks over 10,000 feet; Longs Peak (14,255 feet); hundreds of mountain streams and lakes (6).

LARGEST CITIES (1950 census)

Denver (415,786): state capital; financial, industrial, and railroad center of Rocky Mountain area; stockyards, meat packing; beet-sugar refineries; mining, allied industries; petroleum refineries; educational center.

Pueblo (63,685): manufacturing and wholesale-trade center; iron and steel products; ordnance depot.

Colorado Springs (45,472): resort city below Pikes Peak; ore refining; coal mining; clay products.

Greeley (20,354): agricultural center; beet sugar.

Boulder (19,999): resort center; University of Colorado.

Englewood (16,869): retail center and suburb of Denver.

Fort Collins (14,937): beet sugar, cement, welders.

Grand Junction (14,504): agricultural and mining center.

*Numbers in parentheses are keyed to map.

Colorado Fact Summary

STATE FOREST*

Colorado State Forest (Jackson & Larimer Counties)—70 881 acres (1)

NATIONAL FORESTS*

Arapaho — 1 102 974 acres hdqrs Idaho Springs (15)

Grand Mesa—679 810 acres hdqrs Grand Junction (20)

Gunnison—1 562 644 acres hdqrs Gunnison (26)

Manti La Sal—2b 674 acres in state total 1 339 448 acres Colo and Utah hdqrs, Price Utah (29)

Pike—1 2o8 82o acres hdqrs Colorado Springs (19)

Rio Grande—1 882 825 acres hdqrs, Monte Vista (38)

Roosevelt—1 085 143 acres hdqrs Fort Collins (2)

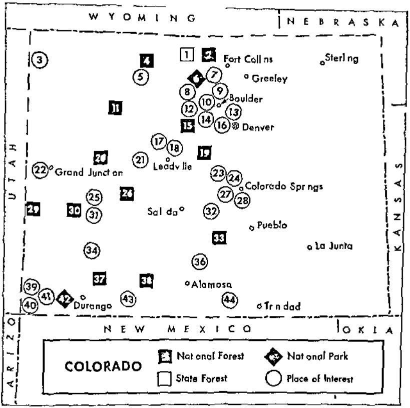
Routt—1 068 630 acres hdqrs Steamboat Springs (4)

San Isabel—1 287 447 acres hdqrs Pueblo (33)

San Juan—2 086 474 acres hdqrs Durango (37)

Uncompahgre—1 051 992 acres hdqrs Delta (30)

White River—2 090 1 0 acres hdqrs Glenwood Springs (11)



PLACES OF INTEREST*

Arapahoe Glacier—one of largest active glaciers in Rockies supplies water for city of Boulder (10)

Aspen—scenic winter sports center long ski run (21)

Black Canyon of the Gunnison National Monument—10 mi gorge near Montrose amazing rock forms (26)

Boulder—health resort University of Colorado (9)

Bridal Veil Falls mountain stream cascades 365 feet down sheer cliff near Telluride (34)

Cave of the Winds—near Manitou Springs Williams Canyon wall hollowed out by underground waters (24)

Central City—once a gold rush boom town old opera house restored used for annual play festival (14)

Climax—largest molybdenum mine in the world (18)

Colorado National Monument—near Grand Junction giant sandstone shafts many canyons and caves (22)

Cripple Creek—site of famous old mining camp (27)

Denver—many places of interest (*see* Denver) (13)

Dinosaur National Monument—in Utah and Colo rich fossil beds reached from Jensen Utah (3)

Estes Park—east gateway to Rocky Mt Natl Park (7)

Four Corners—in southwest corner only spot in U S where 4 states meet—Colo Utah Ariz N M (40)

Garden of the Gods—weird red sandstone formations in hilly area near Colorado Springs (24)

Gilman—one of largest zinc mines in the world (17)

Grand Lake—large glacial lake and resort area (8)

Great Sand Dunes National Monument—desert of ever shifting dunes 38 miles northeast of Alamosa (36)

Gunnison Diversion Tunnel irrigation tunnel 6 miles long 7 miles east of Montrose (31)

Hovenweep National Monument—4 groups of prehistoric ruins in Colorado and Utah 2 in Colorado located 3 mi s west of Cortez (39)

Leadville—one of highest cities in U S (almost two mi above sea level) in rich mining region (18)

Lookout Mountain rock tomb of Buffalo Bill Cody at summit Cody Memorial Museum near Golden (16)

Moffat Tunnel—6 1 mi tunnel under James Peak cuts railroad distance Denver to Salt Lake City 176 mi (12)

Monument Lake—hunting fishing near Trinidad (44)

Mount of the Holy Cross huge cross formed by snow filled crevices on mountainside near Gilman (1)

Pagosa Springs—hot mineral medicinal springs (43)

Park of the Red Rocks—natural theater nr Denver (13)

Petrified Forest—Florissant red sandstone trees (23)

Pikes Peak—Colorado Springs famous landmark cog railway and highway ascend to Summit House (24)

Royal Gorge—canyon of Arkansas R spanned by world s highest suspension bridge near Canon City (32)

Shadow Mountain National Recreation Area—reservoirs of Colorado-Big Thompson Project north of (8)

Steamboat Springs—hunting fishing winter sports (5)

Will Rogers Shrine of the Sun—on Cheyenne Mt (28)

Yucca House National Monument—prehistoric Indian village mostly buried in earth mounds near Cortez (41)

*Numbers in parentheses are keyed to map

Colorado Fact Summary

THE PEOPLE BUILD THEIR STATE

1541—Coronado, returning to Mexico from fruitless search for rich Indian cities, probably crosses what is now southeast Colorado.

1706—Juan de Ulibarri takes formal possession of area for Spain.

1720—Pedro de Villasur of New Mexico leads unsuccessful expedition against French traders reported to be in the region.

1739—Paul and Pierre Mallet, Frenchmen, cross southeastern Colorado en route to New Mexico.

1762—France cedes to Spain all claims west of Mississippi River; France secretly regains possession in 1800

1765—Juan Maria Rivera hunts gold in Colorado.

1776—Friar Silvestre Vélez de Escalante and Friar Francisco Domínguez cross western Colorado in search of route from New Mexico to California.

1799—French explorer Jean de la Maisonveuve visits present site of Denver.

1803—Louisiana Purchase makes eastern part of Colorado American territory. Trappers (mountain men) begin to enter region.

1806—Zebulon Pike leads exploring party up Arkansas River; discovers peak later named for him. Pike goes too far west; Spaniards arrest him in 1807.

1819—Treaty with Spain gives U. S. part of present Colorado north of Arkansas River and east of Continental Divide.

1820—Stephen H. Long and party of scientists explore much of what is now Colorado.

1821—Western Colorado becomes part of Mexico as Mexico becomes independent of Spain.

1828—William Bent and partners begin to build Bent's Fort, now La Junta, finishing it in 1832. Fort becomes center for such famous scouts as Jim Bridger and Kit Carson. Fort is abandoned, 1852; Bent builds new one at Fort Lyon.

1836—Texas claims part of Colorado region from Mexico: issue becomes one of causes of Mexican War. Louis Vasques and Andrew Sublette build post for Rocky Mountain Fur Company near site of Denver; post captured and looted by Arapahoes in 1842.

1840—Cheyenne, Arapaho, Kiowa, and Comanche Indians meet in council on Arkansas River; form Four Nation Alliance to fight white settlers.

1842—First of three major expeditions led by John C. Frémont crosses Colorado; last coming in 1853.

1848—By Treaty of Guadalupe-Hidalgo, ending Mexican War, Mexico cedes western Colorado to U. S. Western Colorado region incorporated into New Mexico and Utah territories; eastern part belonged to Nebraska and Kansas territories.

1851—First permanent white settlement in Colorado made at San Luis.

1852—Fort Massachusetts, first U. S. military post in area, established in San Luis Valley, but is soon abandoned for Fort Garland nearby. Gold discovered near mouth of Clear Creek.

1854—Ute Indians attack Fort Pueblo, killing most of settlers there.

1855—Indians attack Spanish colony at Guadalupe but are defeated.

1858—Gold discovered on South Platte River near present site of Denver; state constitution drafted but is not approved. Settlers organize movement to form Jefferson Territory; unrecognized "territorial government" exists until 1861.

1859—Thousands of prospectors swarm into Colorado in Pikes Peak gold rush. J. H. Gregory discovers gold vein near present Central City. Pikes Peak Express begins stage service from Leavenworth, Kan., to Denver.

1861—Congress creates Colorado Territory, February 28, along present boundaries of state; capital, Colorado City; governor, William Gilpin. Arapaho and Cheyenne Indians by treaty cede most of their territory in Colorado. University of Colorado authorized; opens at Boulder, 1877.

1862—First oil in territory discovered near Florence. Golden becomes territorial capital.

1863—Telegraph links Denver and the East.

1864—U. S. troops attack Arapaho and Cheyenne Indians at Sand Creek. Colorado Seminary, now Denver University, founded.

1866—President Andrew Johnson vetoes Colorado statehood measure passed by Congress.

1867—Denver named permanent capital of territory.

1868—Cheyenne Indians defeated on Arickaree River at battle of Beecher Island, virtually ending Indian war. Utes assigned to southwestern Colorado, but soon white settlers clamor for admission to area. Utes cede mineral-rich San Juan district, 1873 First smelter in Colorado built at Blackhawk.

1870—Denver and Pacific Railway links Denver with Cheyenne, Wyo., and Union Pacific Railway. Union Colony, co-operative agricultural settlement, established by Nathan C. Meeker at Greeley, named for Horace Greeley, project's sponsor.

1872—Denver and Rio Grande Railway completed to Pueblo.

1874—Southern Cheyennes surrender; resettled in Oklahoma. Colorado College founded, Colorado Springs.

1875—Constitutional convention meets at Denver.

1876—Colorado admitted to the Union, August 1; capital, Denver; governor, John L. Routt.

1877—Lead and silver boom begins at Leadville.

1879—Utes attack settlers at White River Agency; are defeated and removed to Utah, 1881.

1891—Gold discovered at Cripple Creek.

1896—State Capitol building in Denver finished.

1899—Sugar-beet culture introduced from Germany. First sugar-beet factory built at Grand Junction. Denver's pioneering Juvenile Court established.

1906—U. S. Mint at Denver begins operations. Mesa Verde National Park created.

1909—Gunnison Diversion Tunnel opened for irrigation of Uncompahgre Valley.

1910—Initiative, referendum, direct primary adopted.

1914—Mine strike at Ludlow leads to passage of progressive labor laws, 1915.

1915—Rocky Mountain National Park created.

1927—Moffat Tunnel under Continental Divide opens.

1934—Dotsero cutoff through Moffat Tunnel puts Denver on direct transcontinental rail route.

1937—Colorado-Big Thompson irrigation project authorized.

1947—Alva B. Adams Transmountain Tunnel for water opened from Grand Lake to Big Thompson River.

1948—New State Department of Education created.

1949—Goethe Bicentennial celebrated at Aspen.

1951—Work begins on atomic plant on Rocky Flats south of Boulder. State regulates rain making.

1952—Colorado Valley Highway, four-lane road between Denver and Colorado Springs, opens.

1953—Denver-Boulder Turnpike, a toll road, completed.

COLORADO

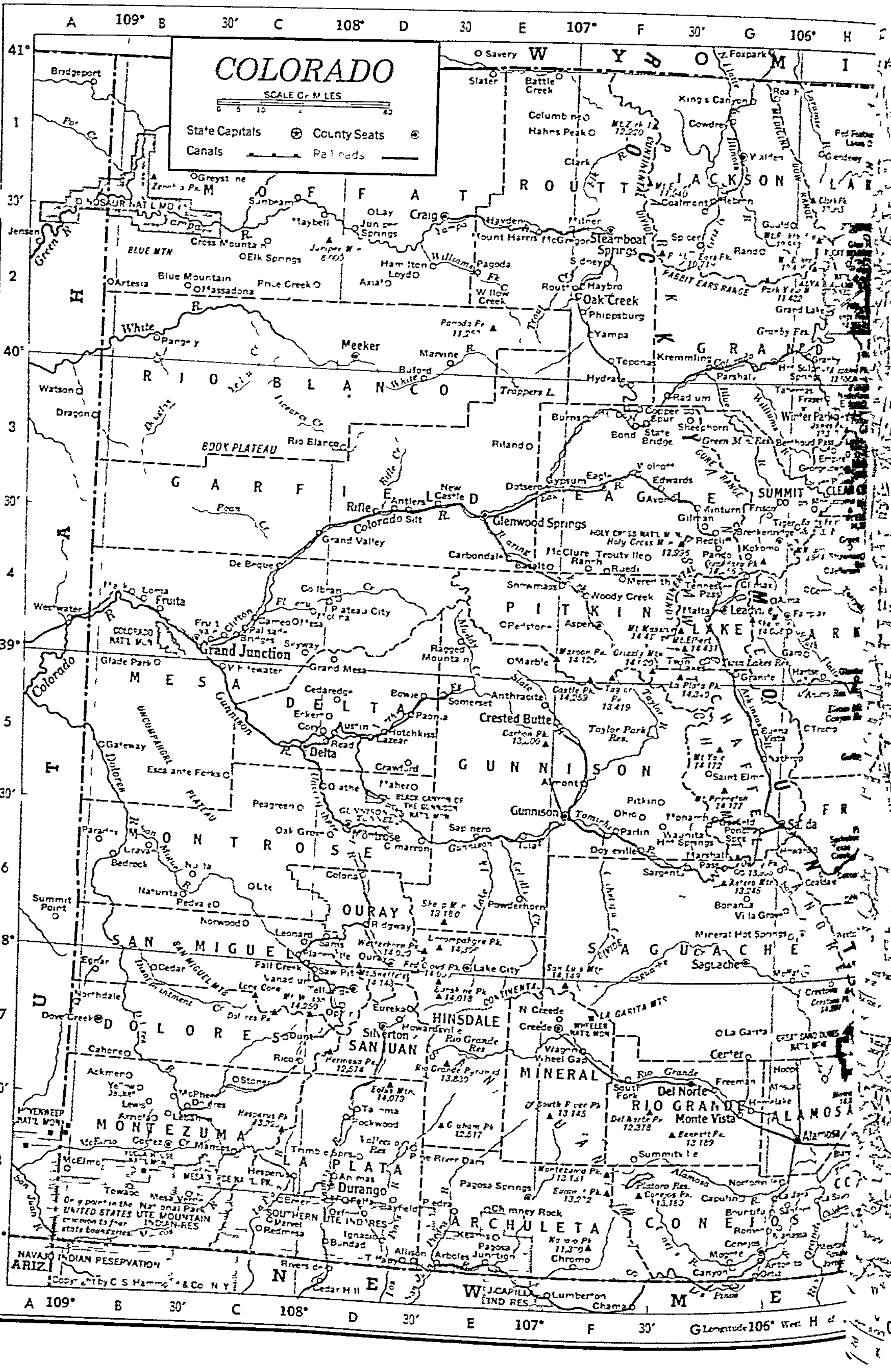
COUNTIES

Adams 40 234 L 3
Alamosa 10 531 H 7
Arapahoe 52 125 L 3
Archuleta 3 030 E 8
Baca 7 964 O 8
Bent 8 775 N 7
Boulder 48 296 J 2
Chaffee 7 168 G 5
Cheyenne 3 453 O 5
Clear Creek 3 289 H 3
Conejos 10 171 G 8
Costilla 6 067 J 8
Crowley 5 222 M 6
Custer 1 573 J 6
Delta 17 365 D 5
Denver 415 786 K 3
Dolores 1 966 C 7
Douglas 3 507 K 4
Eagle 4 488 F 3
El Paso 74 523 K 5
Elbert 4 477 L 4
Fremont 13 366 J 5
Garfield 11 625 C 3
Gilpin 850 H 3
Grand 3 963 G 2
Gunnison 5 716 E 5
Hinsdale 263 E 7
Huerfano 10 549 K 7
Jackson 1 976 G 1
Jefferson 55 687 J 3
Kiowa 3 003 O 6
Kit Carson 8 600 O 4
La Plata 14 880 D 8
Lake 6 150 G 4
Larimer 43 554 H 1
Las Animas 25 902 L 8
Lincoln 5 909 M 5
Logan 17 187 N 1
Mesa 38 974 B 5
Mineral 698 F 7
Moffat 5 946 C 1
Montezuma 9 991 B 8
Montrose 15 220 C 6
Morgan 18 074 M 2
Otero 25 275 M 7
Ouray 2 103 D 6
Park 1 870 H 4
Phillips 4 924 P 1
Pitkin 1 646 F 4
Prowers 14 836 P 7
Pueblo 90 188 K 6
Rio Blanco 4 719 C 3
Rio Grande 12 832 G 7
Routt 8 940 E 1
Saguache 5 664 G 6
San Juan 1 471 D 7
San Miguel 2 693 C 6
Sedgwick 5 095 P 1
Summit 1 135 G 3
Teller 2 754 J 5
Washington 7 520 N 3
Weld 67 504 L 1
Yuma 10 827 P 2

CITIES AND TOWNS

Abarr 8 O 3
Ackmen B 7
Adams City 800 K 3
Adena M 2
Agate 134 M 4
Aguilar 1 038 K 8
Akron 1 605 N 2
Alamosa 5 354 H 8
Allenspark 100 J 2
Allison 105 E 8
Alma 149 G 4
Almont F 5
Amherst 101 P 1
Amity P 6
Andrix 10 N 8
Animas 2 500 D 8
Anthracite E 5
Antlers 150 D 3
Anton 50 N 3
Antonito 1 255 H 8
Arapahoe 1[illegible]5 P 5
Arboles 108 E 8
Arickaree 13 N 3
Arlington 25 N 6
Armel 4 P 3
Aroya N 5
Arriba 367 N 4
Arriola 350 B 8
Artesia 281 B 2
Arvada 2 359 J 3
Aspen 916 F 4
Association Camp J 2
Atwood 200 N 1
Ault 666 K 1
Aurora 11 421 K 3
Avon 60 F 3
Avondale 15[illegible] L 6
Axial D 2
Ayer 7 M 7
Bailey 75 H 4
Barela 9 L 8
Barnesville 35 L 2
Barr Lake 100 K 3
Bartlett 30 P 8
Basalt 173 E 4
Battle Creek 18 E 1
Bayfield 335 D 8
Bedrock 15 B 6
Beecher Island 10 P 3
Bellvue 300 J 1
Bennett 272 L 3
Berthoud 867 J 2
Berthoud Pass H 3
Bethune 71 P 4
Beulah K 6
Big Bend 30 O 6
Black Forest 10 K 4
Black Hawk 166 J 3
Blanca 376 H 8
Blende 575 K 6
Blue Mountain 6 B 2
Bonanza 51 G 6
Boncarbo 97 K 8
Bond 125 F 3
Bondad 2 D 8
Boone 468 L 6
Boulder 19 999 J 2
Bountiful 100 G 8
Bovina 23 N 4
Bowie 250 D 5
Boyero 36 N 5
Bracewell 5 K 2
Brandon 50 I 6
Branson 157 M 8
Breckenridge 296 C 4
Breed 20 K 5
Breen C 8
Bridges 60 C 4
Briggsdale 200 L 1
Brighton 4 336 K 3
Bristol 250 P 6
Brookside 175 J 6
Brookvale 15 H 3
Broomfield 125 J 3
Brush 2 431 M 2
Buckeye 37 J 1
Buckingham 36 L 1
Buena Vista 753 G 5
Buffalo Creek 50 J 4
Buford 30 D 2
Buick 31 M 4
Burlington 2 247 P 4
Burns 200 F 3
Byers L 3
Caddoa 32 O 6
Cahone 103 B 7
Calhan 375 L 4
Cameo 100 C 4
Campion J 2
Campo 266 O 8
Canfield 65 J 2
Canon City 6 345 J 6
Canyon G 8
Capulin G 8
Carbondale 441 E 4
Carlton 65 P 6
Carr 95 K 1
Cascade 75 K 5
Castle Rock 741 K 4
Cedar B 7
Cedaredge 574 D 5
Cedarwood 85 K 7
Center 2 024 G 7
Central City 371 J 3
Chama 760 J 8
Cheraw 174 N 6
Cherry Hills Village 750 K 3
Cheyenne Wells 1 154 P 5
Chimney Rock 100 E 8
Chivington O 6
Chromo 200 F 8
Cimarron 150 D 6
Clark F 1
Clarkville 4 P 2
Clifton 970 C 4
Climax 750 G 4
Coalcreek 195 J 6
Coaldale 130 H 6
Coalmont 26 F 1
Cokedale 214 K 8
Collbran 237 C 4
Colona 125 D 6
Colorado Springs 45 472 K 5
Columbine E 1
Como 39 H 4
Conejos G 8
Cope 145 O 3
Copper Spur 36 F 3
Cornish 140 L 2
Cortez 2 680 B 8
Cory C 5
Cotopaxi 210 H 6
Cowdrey G 1
Craig 3 080 D 2
Crawford 170 D 5
Creede 503 E 7
Crested Butte 730 E 5
Crestone 72 H 7
Cripple Creek 853 J 5
Critchell 75 J 4
Crook [illegible]59 O 1
Cross Mountain 10 B 2
Crowley 379 M 6
Cuchara Camps 2 J 8
Dacono 258 K 2
Dailey 90 O 1
De Beque 253 C 4
De Nova 4 O 3
Deckers J 4
Deer Trail 421 M 3
Del Norte 2 048 G 7
Delagua 239 K 8
Delcarbon 200 K 7
Delhi 36 M 7
Delta 4 097 D 5
DENVER 415 786 K 3
Deora 41 O 7
Derby 2 840 K 3
Devine 116 L 6
Dillon 191 H 3
Divide 50 J 5
Dolores 729 C 8
Dotsero 59 E 3
Dove Creek 702 A 7
Doyleville 105 F 6
Drake 70 J 2
Dunton C 7
Dupont 400 K 3
Durango 7 459 D 8
Eads 1 015 O 6
Eagle 445 F 3
Earl L 8
East Canon 761 J 6
Eastlake 194 K 3
Eaton 1 276 K 2
Eckert C 5
Eckley 295 P 2
Edgewater 2 580 J 3
Edison 15 L 5
Edler O 8
Edwards F 3
Egnar 35 B 7
Elba 25 N 3
Elbert 200 L 4
Eldora H 3
Elizabeth 253 K 4
Elk Springs 35 C 2
Elkton 10 J 5
Elwell 40 K 2
Empire 2[illegible]8 H 3
Englewood 16 869 K 3
Erie 937 *K 2*
Escalante Forks [illegible]0 B 5
Estes Park 1 617 J 2
Eureka 13 D 7
Evans 862 K 2
Evergreen 800 J 3
Fairplay 476 H 4
Falcon K 5
Falfa 300 D 8
Fall Creek 25 C 7
Farisita 125 J 7
Farmers Spur 22 K 2
Farr K 7
Federal Heights 173 *K 3
Firestone 297 K 2
Firstview 30 O 5
Fitzsimons 5 000 K 3
Flagler 793 N 4
Fleming 377 O 1
Florence 2 773 J 6
Florissant 53 J 5
Fondis 9 L 4
Forder 26 M 5
Fort Collins 14 937 J 1
Fort Garland J 8
Fort Lupton 1 907 K 2
Fort Lyon N 6
Fort Morgan 5 315 M 2
Fosston L 1
Fountain 713 K 5
Fowler 1 025 L 6
Foxton J 4
Franktown 25 K 4
Fraser 400 H 3
Frederick 599 K 2
Freeman 100 G 7
Freshwater (Guffey) 20 H 5
Frisco 87 G 3
Fruita 1 463 B 4
Fruitvale 2 275 B 4
Galatea 10 N 6
Galeton [illegible]00 K 1
Garcia 3[illegible]0 J 8
Garden City 104 *L 1
Gardner 200 J 7
Garfield 100 G 5
Garo 50 H 4
Gary 6 M 2
Gateway 250 B 5
Genoa 257 N 4
Georgetown 329 H 3
Gilcrest 429 K 2
Gill 375 K 2
Gilman 300 G 3
Glade Park 250 B 5
Glen Haven 40 H 2
Glendevey 15 H 1
Glentivar 5 H 4
Glenwood Springs 2 412 E 4
Golden 5 238 J 3
Goldfield 81 J 5
Good Pasture 48 K 6
Goodrich 30 M 2
Gordon K 7
Gould 150 G 1
Gowanda 12 K 2
Granada 551 P 6
Granby 463 H 2
Grand Junction 14 504 C 4
Grand Lake 309 H 2
Grand Mesa D 4
Grand Valley 296 D 4
Granite 75 G 4
Grant 25 H 4
Greeley 20 354 K 2
Green Mountain *Falls* *106* *K 5*
Greenhorn 20 K 7
Greenland 75 K 4
Greenwood J 6
Greystone 2 B 1
Grover 146 L 1
Guffey [illegible]0 H 5
Gulnare 200 K 8
Gunnison 2 770 E 5
Gypsum 345 F 3
Hahns Peak E 1
Hale 240 P 3
Hamilton 25 D 2
Hardin L 2
Harmony 18 J 2
Harrisburg 6 N 3
Hartman 181 P 6
Hartsel 85 H 4
Hastings 300 K 8
Hasty O 6
Haswell 163 N 6
Haxtun 1 006 O 1
Haybro 150 F 2
Hayden 767 E 2
Hebron 4 G 1
Henderson 50 K 3
Hereford 100 L 1
Hesperus C 8
Higbee 6 M 7
Hill Top 10 K 4
Hillrose 190 N 2
Hillside 10 H 6
Hoehne 500 L 8
Holly 1 236 P 6
Holyoke 1 558 P 1
Homelake 250 G 7
Hooper 103 H 7
Hot Sulphur Springs 263 H 2
Hotchkiss 715 D 5
Howard 210 H 6
Howardsville 20 E 7
Hoyt 250 L 2
Hudson 365 K 2
Hughes 6 O 3
Hugo 943 N 4
Husted 30 K 4
Hyde O 2
Hydrate F 2
Hygiene 200 J 2
Idaho Springs *1 [illegible]69* *H 3*
Idalia 74 P 3
Ignacio 526 D 8
Iliff 235 N 1

*No room on map for name.


COLORADO
SCALE OF MILES
State Capitals
County Seats
Canals
Railroads
WYOMING
MOFFAT
ROUTT
JACKSON
RIO BLANCO
GRAND
GARFIELD
EAGLE
SUMMIT
PITKIN
LAKE
MESA
DELTA
GUNNISON
CHAFFEE
MONTROSE
OURAY
SAN MIGUEL
SAGUACHE
HINSDALE
SAN JUAN
DOLORES
MINERAL
RIO GRANDE
ALAMOSA
MONTEZUMA
LA PLATA
ARCHULETA
CONEJOS
UTAH
ARIZ
NEW MEXICO
Craig
Meeker
Steamboat Springs
Oak Creek
Rifle
Glenwood Springs
Grand Junction
Fruita
Delta
Montrose
Gunnison
Crested Butte
Salida
Leadville
Ouray
Silverton
Durango
Cortez
Del Norte
Monte Vista
Alamosa
Saguache
Lake City
Creede
Pagosa Springs
Dove Creek
Colorado R.
Gunnison R.
Dolores R.
White R.
Green R.
Rio Grande
BOOK PLATEAU
UNCOMPAHGRE PLATEAU
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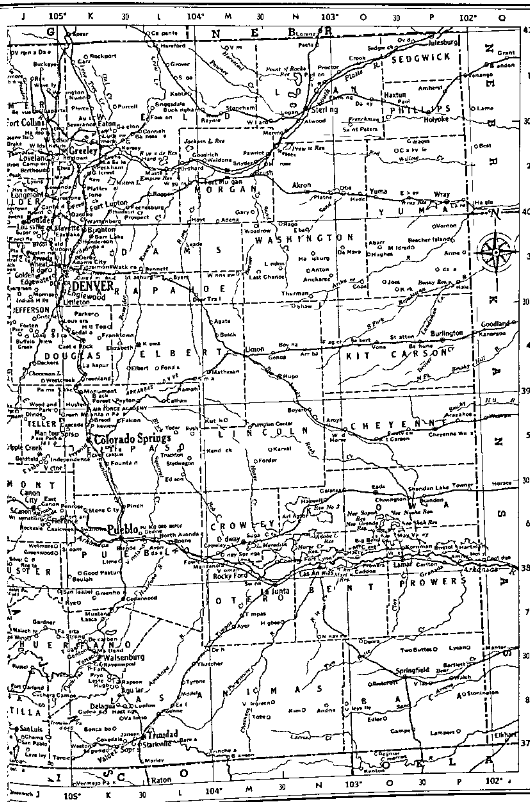

J
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WASHINGTON
YUMA
ADAMS
ARAPAHOE
DOUGLAS
ELBERT
KIT CARSON
LINCOLN
CHEYENNE
TELLER
EL PASO
CROWLEY
PUEBLO
OTERO
BENT
PROWERS
HUERFANO
LAS ANIMAS
BACA
JEFFERSON
Julesburg
Holyoke
Sterling
Fort Collins
Greeley
Loveland
Longmont
Boulder
Brighton
Fort Lupton
Fort Morgan
Brush
Akron
Yuma
Wray
DENVER
Englewood
Littleton
Golden
Limon
Burlington
Goodland
Colorado Springs
Manitou Springs
Cripple Creek
Canon City
Florence
Pueblo
Rocky Ford
La Junta
Las Animas
Lamar
Walsenburg
Trinidad
Starkville
Raton
Springfield
Hugo
Eads
Holly
Elkhart
Arkansas
Platte R
AIR FORCE ACADEMY

Independence	20	K 5
Indian Hills	300	J 3
Iola	50	E 6
Ione	100	K 2
Irondale	325	K 3
Ironton	6	*D 7
Ivywild	2,849	K 5
Jamestown	118	J 2
Jansen	1,500	K 8
Jaroso	250	H 8
Jefferson	75	H 4
Joes	109	O 3
Johnstown	897	K 2
Julesburg	1,951	P 1
Juniper Springs	6	D 2
Karval	90	N 5
Kearns		E 8
Keenesburg	432	L 2
Kelim	50	J 2
Kendrick	14	M 5
Keota	21	L 1
Kersey	304	L 2
Kim	475	N 8
King's Canyon		G 1
Kiowa	173	L 4
Kirk	125	P 3
Kit Carson	379	O 5
Kokomo	53	G 4
Kornman	75	O 6
Kremmling	623	G 2
Kutch	3	M 5
La Garita		G 7
La Jara	912	H 8
La Junta	7,712	M 7
La Salle	797	K 2
La Sauces		H 8
La Veta	701	J 8
Lafayette	2,090	K 3
Laird	155	P 2
Lake City	141	E 6
Lake George	30	J 5
Lakeside	46	*J 3
Lamar	6,829	O 6
Lamport		O 8
Laporte	500	J 1
Larkspur	200	K 4
Las Animas	3,223	N 6
Lascar		K 7
Last Chance	25	M 3
Lavalley		J 8
Lawson	200	H 3
Lay		D 2
Lazear	100	D 5
Leader	67	L 3
Leadville	4,081	G 4
Lebanon	150	C 8
Leonard	10	C 6
Lester	19	K 8
Lewis	50	B 7
Lime	22	K 6
Limon	1,471	M 4
Lindon	29	N 3
Littleton	3,378	K 3
Livermore	150	J 1
Logan		N 1
Log Cabin		J 1
Loma	400	B 4
Longmont	8,099	J 2
Longs Peak	7	J 2
Longview		J 4
Louisville	1,978	J 3
Louviers	250	K 4
Loveland	6,773	J 2
Loyd	82	D 2
Lucerne	100	K 2
Ludlow	200	L 8
Lycan	6	P 7
Lyons	689	J 2
Mack	185	B 4
Maher		D 5
Maitland		K 7
Malachite		J 7

Malta	25	G 4
Manassa	832	H 8
Mancos	785	C 8
Manitou Springs	2,580	J 5
Manzanola	543	M 6
Marble	8	E 4
Marshall Pass	8	G 6
Marvel	110	C 8
Marvine	25	D 2
Masonville		J 2
Massadona	3	B 2
Masters		L 2
Matheson	100	M 4
May Valley	20	O 6
Maybell	106	C 2
McClave	125	O 6
McClure Ranch	25	F 4
McCoy		F 3
McElmo	50	B 8
McGregor	25	E 2
McPhee	30	C 7
Mead	186	K 2
Meeker	1,658	D 2
Meredith	25	F 4
Merino	209	N 2
Mesa	300	C 4
Mesa Verde Nat'l Park	106	C 8
Mesita		H 8
Messex	25	N 2
Mildred	3	O 3
Milliken	510	K 2
Milner	150	F 2
Mineral Hot Springs	10	G 6
Minturn	509	G 3
Model	300	L 8
Moffat	109	H 6
Mogote	150	G 8
Molina		D 4
Monarch	13	G 5
Monte Vista	3,272	G 7
Montezuma	48	H 3
Montrose	4,964	D 6
Monument	126	K 4
Morley	300	L 8
Morrison	306	J 3
Mosca	130	H 7
Mount Harris	700	E 2
Mountain View	878	*J 3
Mustang	10	K 7
Nathrop		H 5
Naturita	500	B 6
Nederland	266	H 3
Nevadaville	6	*H 3
New Castle	483	E 3
New Raymer	130	M 1
Ninaview	2	N 7
Niwot	160	J 2
North Avondale	22	L 6
North Creede		F 7
Northdale	50	B 7
Nortonville	25	G 8
Norwood	294	C 6
Nucla	457	B 6
Nunn	182	K 1
Oak Creek	1,488	F 2
Oak Grove	35	C 6
Ohio	40	F 5
Olathe	810	D 5
Olney Springs	279	M 6
Ophir	2	D 7
Orchard	956	L 2
Ordway	1,290	M 6
Ortiz		H 8
Otis	532	O 2
Ouray	1,089	D 6
Ovid	664	P 1
Oxford		D 8

Padroni	153	N 1
Pagoda		E 2
Pagosa Jct		E 8
Pagosa Springs	1,379	E 8
Palisade	861	C 4
Palmer Lake	263	J 4
Pando	17	G 4
Paoli	91	P 1
Paonia	1,257	D 5
Paradox	50	B 6
Parkdale	20	H 6
Parker	132	K 4
Parlin	50	F 6
Parshall	81	G 2
Pawnee		M 2
Peagreen	10	C 5
Peckham	40	K 2
Peetz	232	N 1
Penrose	90	K 6
Peyton		K 4
Phippsburg	360	F 2
Piedra		E 8
Pierce	372	K 1
Pikeview	300	K 5
Pine	75	J 4
Pine River Dam		E 8
Pinecliffe	25	J 3
Pinon	65	K 6
Pitkin	152	F 5
Placerville	50	D 6
Plainview	100	J 3
Plateau City	20	D 4
Platner	49	N 2
Platteville	570	K 2
Poncha Sprs.	114	G 6
Portland	205	K 6
Portland	16	*D 6
Powderhorn	90	E 6
Price Creek	2	C 2
Pritchett	286	O 8
Proctor	40	N 1
Prospect	62	L 2
Prospect Heights	50	*J 6
Prowers	36	O 6
Pryor	25	K 8
Pueblo	63,685	K 6
Pumpkin Center		M 5
Purcell	30	K 1
Radium	20	F 3
Ragged Mountain		E 4
Rago		N 3
Ramah	142	L 4
Rand	30	G 2
Rangely	808	B 2
Rapson	50	K 8
Ravenwood		K 7
Raymer (New Raymer)	130	M 1
Read		D 5
Recen (Kokomo)	53	G 4
Red Feather Lakes	93	H 1
Red Wing	16	J 7
Redcliff	556	G 4
Redmesa		C 8
Redstone	50	E 4
Redvale	70	B 6
Rex		J 1
Rico	212	C 7
Ridgway	209	D 6
Rifle	1,525	D 3
Riland	25	E 3
Rio Blanco	3	C 3
Roach		G 1
Rockport	2	K 1
Rockvale	380	J 6
Rockwood	15	D 8
Rocky Ford	4,087	M 6

Roggen	150	L 2
Romeo	404	G 8
Rosedale	57	*K 2
Rosita	20	J 6
Routt	50	E 2
Rowena	3	J 2
Ruedi	25	F 4
Rugby		K 8
Rush	18	L 5
Russell	43	J 7
Rye	166	K 7
Saguache	1,024	G 6
Saint Elmo		G 5
Saint Peters	200	O 2
Salida	4,553	H 6
Sams	15	D 6
San Acacio	135	H 8
San Isabel	25	K 7
San Luis	1,239	J 8
San Pablo		J 8
Sanford	666	H 8
Sapinero	30	E 6
Sargents	135	F 6
Saw Pit	20	D 7
Sedalia		K 4
Sedgwick	332	O 1
Segundo	300	K 8
Seibert	346	O 4
Severance	108	K 1
Shaffers Cross.	40	J 4
Shaw	4	N 3
Shawnee		H 4
Sheephorn		G 3
Sheridan	1,715	*K 3
Sheridan Lake	100	P 6
Sidney		F 2
Silica	3	J 4
Siloam	16	K 6
Silt	361	D 4
Silver Cliff	217	J 6
Silver Plume	136	H 3
Silverton	1,375	D 7
Simla	424	M 4
Skyway		C 4
Slater	15	E 1
Sligo		L 1
Snowmass	200	E 4
Snyder	250	M 2
Somerset		E 5
Sopris	1,330	K 8
South Canon	1,588	J 6
South Fork		F 7
Spicer	10	F 2
Spikebuck		H 5
Springfield	2,041	O 8
Starkville	1,000	L 8
State Bridge	2	F 3
Steamboat Springs	1,913	F 2
Stellwagon	2	L 5
Sterling	7,534	N 1
Stone City	75	K 6
Stoneham	75	M 1
Stoner	2	C 7
Stonington	44	P 8
Strasburg	520	L 3
Stratton	720	O 4
Strong	20	K 7
Sugar City	527	M 6
Sugar Loaf	6	J 2
Summitville	4	G 8
Sunbeam	29	C 1
Superior	134	J 3
Swallows	50	K 6
Swink	336	M 7
Tabernash	260	H 3
Tacoma	17	D 7
Telluride	1,101	D 7
Tennessee Pass	25	G 4
Tercio	110	J 8
Texas Creek	25	H 6

Thatcher		L 7
Thurman	10	N 3
Tiffany	200	D 8
Tiger	8	G 3
Timnath	177	J 2
Timpas	50	M 7
Tioga	250	K 7
Tobe		M 8
Tolland	10	H 3
Toltec	180	K 7
Toponas	250	F 2
Towaoc		B 8
Towner	150	P 6
Trail Ridge		H 2
Trimble Springs	30	D 8
Trinchera	90	M 8
Trinidad	12,204	L 8
Troutville	16	F 4
Truckton	20	L 5
Trump	25	H 5
Tungsten	6	H 3
Twin Lakes	60	G 4
Two Buttes	121	P 7
Tyrone	50	L 8
Uravan	700	B 6
Ute	9	C 6
Utleyville	8	O 8
Valdez	700	K 8
Vallorso	90	K 8
Vanadium	2	C 7
Vernon		P 3
Victor	684	J 5
Vilas	132	P 8
Villa Grove	200	G 6
Villegreen	150	M 8
Vim	6	M 1
Vineland	200	K 6
Virginia Dale	100	J 1
Vona	209	O 4
Vroman		M 6
Wages	35	P 2
Wagon Wheel Gap		F 7
Walden	696	G 1
Walsenburg	5,596	K 7
Walsh	897	P 8
Ward	10	H 2
Watkins	85	K 3
Wattenberg		K 2
Waunita Hot Springs	80	G 6
Waverly	20	J 1
Weldona	300	M 2
Wellington	541	K 1
Westcliffe	390	H 6
Westcreek		J 4
Westminster	1,686	J 3
Weston	500	K 5
Wetmore	100	J 6
Wheat Ridge	7,000	J 3
Whitewater	150	C 5
Wiggins	400	L 2
Wild Horse	60	N 5
Wilds	25	J 2
Wiley	417	O 6
Willard	29	M 1
Williamsburg	65	J 6
Willow Creek		E 2
Windsor	1,548	J 2
Winnview		M 3
Winter Park	100	H 3
Wolcott	50	F 3
Woodland Park	391	J 4
Woodrow		M 3
Woody Creek	7	F 4
Wray	2,198	P 2
Yampa	421	F 2
Yellow Jacket		B 7
Yoder	30	L 5
Yuma	1,905	O 2

*No room on map for name.

West of the Rocky Mountain National Park lies Shadow Mountain National Recreation Area It features Shadow Mountain Lake and Granby Reservoir two units of the Colorado-Big Thompson Project for irrigation and power

Another national park Mesa Verde contains well preserved homes and relics of the Cliff Dwellers They were Indians who built elaborate community homes high up on the sides of cliffs to escape their enemies (*see* Cliff Dwellers)

Other scenic wonders are mountain ranges—the eastern Front Range the central Park and Sawatch ranges Sangre de Cristo in the south and San Juans in the southwest The highest peak is Mount Elbert (14 431 feet)

In the Front Range is the spectacular Royal Gorge, west of Canon City The world s highest suspension bridge spans the canyon 1 053 feet above the Arkansas River Another gorge is the Black Canyon of the Gunnison a national monument Other monuments preserve varied attractions from dinosaur relics to sand dunes (*see* Colorado Fact Summary, National Parks)

An interesting natural park area is the Garden of the Gods near Colorado Springs This 'garden has many strange and beautifully colored rock formations carved by the weather Among them are twin pinnacles called the Dutch Wedding and a huge mushroomlike boulder named Balanced Rock

Prosperous Farms through Irrigation

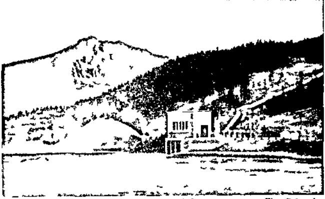
Agriculture is by far Colorado s major source of wealth The wide range of soils temperature and rainfall permits a great variety of crops Wheat the *leading field crop is grown principally* in the eastern plains area Hay is produced throughout the state but mainly in the north and northwest sections

Sugar beets and potatoes are grown chiefly on irrigated farms In average years Colorado is second *only to* California in sugar beet output and yields about one fifth of the nation s crop

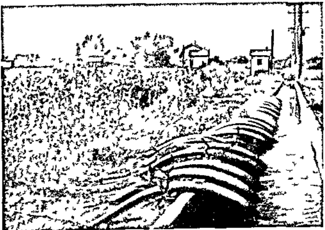
Cattle raising is the largest single source of agricultural income Milk sheep and hogs are also among the important farm products Colorado *raises* fruit chiefly peaches and apples and a variety of truck crops of high quality

Because of light rainfall and its uneven distribution throughout the year, Colorado has made notable use of irrigation projects Today the state has about 3 million acres of irrigated land or

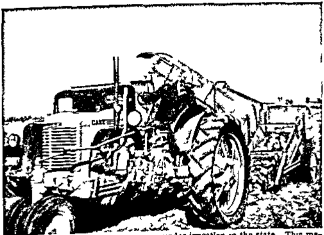
HOW COLORADO FARMS ITS ARID LANDS



In Colorado s dry climate irrigation is vital for many crops The Colorado-*Big Thompson Project diverts water from the western slope of the Rockies* into a tunnel under the Continental Divide to irrigate land on the eastern slope



Irrigation water reaches a farm in a concrete-lined ditch The precious water then flows in siphon tubes into the furrows and to the thirsty plants



Sugar beets are the largest *crop grown under irrigation in the state* This machine drawn by a tractor picks up and loads the sugar beets into a truck.

COLORADO'S MOST NOTED MOUNTAIN

Pikes Peak is an isolated mountain offering a superb view. The road to its summit is the state's second highest highway.

11 per cent of the national total. The state also has nearly 20,000 miles of irrigation canals.

Most of the state's large irrigation systems are on or near the South Platte and Arkansas rivers in the eastern plains section. In the plains region, irrigation helps cattle and sheep growers as well as vegetable farmers. Many irrigated districts are scattered through the central and western parts of the state.

The federal Bureau of Reclamation has built three of Colorado's greatest irrigation systems. In the Uncompahgre project in the west central part of the state, the six-mile Gunnison Tunnel east of Montrose draws water from the Gunnison River for use in the Uncompahgre Valley. Also in west central Colorado a dam near Grand Junction diverts water from the Colorado River into a 55-mile irrigation canal in the Grand Valley project. Most spectacular of the tunnels that carry water from the wet western slope of the Rockies to the drier eastern slope is the 13-mile Alva B. Adams Tunnel of the Colorado-Big Thompson Project in northern Colorado. (*See* Colorado River.)

Colorado's farms average about 833 acres, ranging from small truck gardens to huge livestock ranches of 1,000 acres and larger. In all, the state has more than 45,000 farms; about half are 180 acres or more. In Colorado's sugar-beet fields and on its vegetable farms, the owners require extra labor to harvest their crops. This labor is supplied largely by migrant workers of Russian, Italian, or Mexican extraction.

Manufacturing Enterprises and Cities

Colorado ranks 34th among the states in manufacturing. Some of its industries are important to the entire nation. The most valuable of these is beet-sugar refining. In this Colorado is the leading state. Large sugar refineries are located in Denver and around Greeley, the center of the sugar-beet growing district.

Another large industry is the manufacture of iron and steel. Huge steelworks and rolling mills have made Pueblo the state's leading steel center. One of the largest rubber plants in the United States is in Denver.

The largest city in Colorado is Denver. It is also the state capital and a financial and industrial center (*see* Denver). Pueblo, the second largest city, is a manufacturing and trading center. It lies at the western fringe of the Great Plains.

Colorado Springs, the third city in size, is a beautiful health and recreational resort at the foot of Pikes Peak. Other major cities are Greeley, Boulder, Englewood, Fort Collins, Grand Junction, and Trinidad. Grand Junction is near the Utah border. The other five cities lie at or near the eastern face of the Rocky Mountains.

Coal Leads Gold and Silver among Minerals

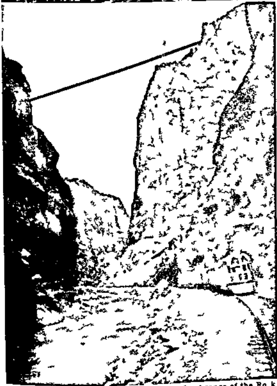
Colorado has more than 250 minerals. Historically, gold and silver have been the greatest sources of the state's income from minerals. Now, however, petroleum, molybdenum, coal, and zinc are the top minerals.

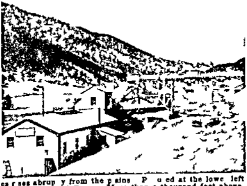
The state's petroleum comes chiefly from Rangely field in the northwest and from the Denver-Julesburg area. Colorado has the nation's largest oil-shale reserves, about 270 billion barrels. The United States Bureau of Mines operates an experimental refinery at Rifle. Colorado leads all states in molybdenum with the world's largest molybdenum mine at Climax. Coal is found on both sides of the Rockies. The state has the nation's greatest bituminous coal reserves, some 300 billion tons. Eagle, San Miguel, and Lake counties lead in zinc output. Almost all the uranium mined in the nation comes from deposits extending from southwestern Colorado into adjoining states. Vanadium production of the United States centers in the Colorado-Utah region. Other important minerals of Colorado are lead, sand and gravel, stone, and copper.

Development of Transportation

Horseback and covered wagon supplied the first transportation link with the East. Then in 1859 the Pikes Peak gold rush brought a stagecoach line between Leavenworth, Kan., and Denver. In 1870, a railroad linked Denver with Cheyenne, Wyo., on the new Union Pacific. The Santa Fe reached Pueblo from Kansas City in 1876. A line also had been built from Denver south to Pueblo, then west to Canon City.

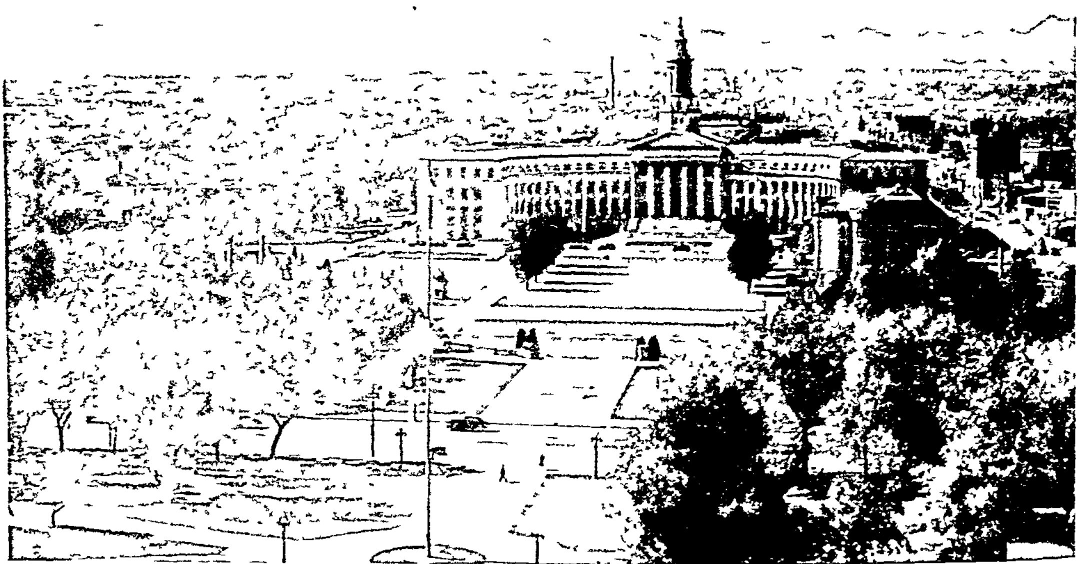
Penetration of the mountainous western half of the state came as various finds of gold and silver provided incentive and means. The main route ran up the Arkansas River from Pueblo to the Continental Divide at Tennessee Pass, thence down the Colorado River valley to Utah. Narrow-gauge lines served the southwest and many mining centers. A route via Salida, Gunnison, and Grand Junction was open to Salt Lake





Only 14 miles from the heart of Denver the front range of the Rockies rises abruptly from the plains. Pictured at the lower left is the Burlington Zephyr racing along the Arkansas River through spectacular Royal Gorge. More than a thousand feet above a highway bridge spans the gorge. Sheep raising in the high mountain meadows and mining are among the leading industries.

DENVER THE "QUEEN CITY" AT THE FOOT OF THE ROCKIES



Denver's handsome City and County Building faces the State Capitol across the broad, formal lawns of the Civic Center Park.

A graceful clock tower houses the Speer Memorial Chimes. On the fourth floor of the building is the Denver Art Museum.

City in 1883. The Dotsero cutoff, completed in 1934 west from Denver to the old line at Dotsero, saved 176 miles of travel. It used the 6.1-mile Moffat Tunnel under the Continental Divide, finished in 1927.

The state's highway system includes 29 passes through the mountains The Colorado Valley Highway, a four-lane superhighway between Denver and Colorado Springs, was completed in 1952. The Denver-Boulder Turnpike, a toll road, was opened in 1953.

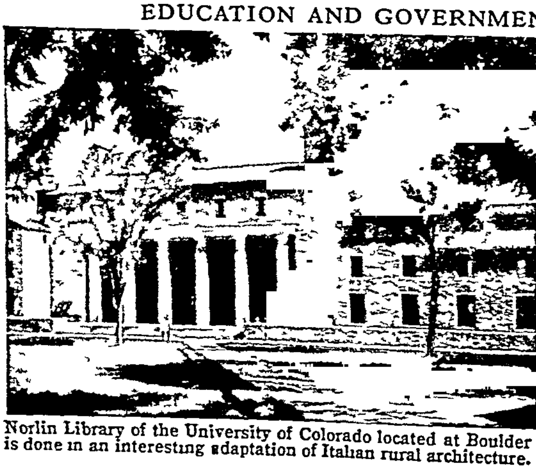
Early History of the State

In 1541 Coronado entered the Colorado area (*see* Coronado). The United States acquired the eastern part through the Louisiana Purchase in 1803 (*see* Louisiana Purchase). Zebulon M. Pike discovered Pikes Peak in 1806 Major S. H. Long and Capt. John C. Frémont, guided by Kit Carson, also explored the region (*see* Frémont; Carson). The western part was added in 1848 as a result of the Mexican War (*see* Mexican War).

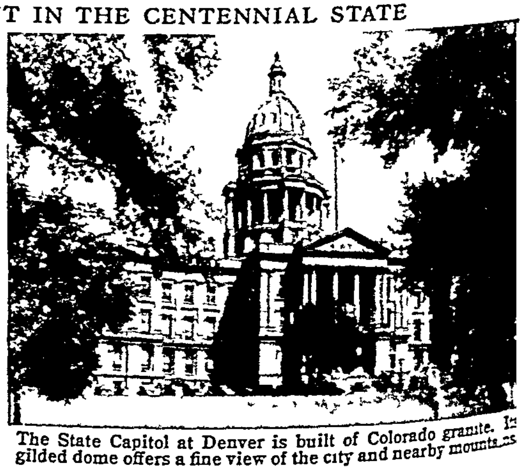
The mountains dampened interest until the discovery of gold in 1858. This led to settlement, organization as a territory, and finally to admission as a state. Thereafter the state experienced booms following discoveries of gold or silver, significant developments in agriculture and industry, and civic advances.

As mining camps gave way to towns and women and children joined the settlements, the state advanced rapidly in educational facilities. Colorado adopted woman suffrage in 1893 and the initiative and referendum in 1910. (*See also* Education section and chronology in Colorado Fact Summary; United States sections "Great Plains" and "Rocky Mountains.")

EDUCATION AND GOVERNMENT IN THE CENTENNIAL STATE



Norlin Library of the University of Colorado located at Boulder is done in an interesting adaptation of Italian rural architecture.



The State Capitol at Denver is built of Colorado granite. Its gilded dome offers a fine view of the city and nearby mountains

COLORADO RIVER The once wild Colorado is now a useful river As it flowed through mountains and deserts in the southwestern United States it carved deep gorges flooded the land and carried away tons of silt The world famous Grand Canyon is its handiwork Flood swollen when mountain snows melted in spring the river was a sluggish stream in late summer

Man however has tamed the Colorado High dams large reservoirs and long canals harness the river Hoover Dam is the world s highest dam and second largest concrete dam in volume It holds back Lake Mead which has the greatest capacity of any reservoir The Colorado River Aqueduct the world s longest carries water to Los Angeles

Mountain Rimmed Basin of Plateaus and Deserts

The Colorado begins in the Rocky Mountains in Colorado and flows southwest 1 4 0 miles to the Gulf of California in Mexico Its 1 360 miles in the United States makes it the nation s fifth longest river It falls about 10 000 feet in its course Of its 9[1] million potential horsepower one fifth has been developed (*see* Water Power)

This large drainage basin covers 242 000 square miles or one twelfth of the United States and another 3 000 square miles in Mexico The Colorado and its tributaries drain southwestern Wyoming and western Colorado parts of Utah Nevada New Mexico and southern California and almost all Arizona (*see* articles on each state and United States section Western Basins and Plateaus)

In the northern three quarters of the watershed are high plateaus with deep canyons Bordering them on the west north and east are the Rockies The rest of the basin is a low desert with some mountains (*see* Deserts) In general the basin is arid

The Colorado is useless for transportation The canyons and rapids of the upper basin are practically impassable and the periodic high tidal bores at its mouth hinder navigation (*see* Tide)

The 1½ million people of the basin are in a few mining and farming areas Thus one per cent of the nation s population lives in 8 per cent of its area The largest cities are Phoenix and Tucson Ariz and Las Vegas Nev all in the south Three fourths of the basin is federal land devoted to national forests and parks and Indian reservations

Agriculture employs the most people but mining produces the most wealth Livestock raising is the main agricultural activity Crops are grown mainly by irrigation (*see* Irrigation) Many minerals are found chiefly copper gold and silver in the south and coal oil and natural gas in the north The climate and scenery draw many tourists to the area

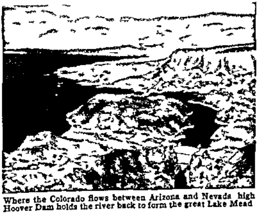
A 1 500 Mile Trip down the River

Many small streams cascade down the western slope of the Continental Divide in Rocky Mountain National Park in Colorado to form the Colorado River The young river is immediately put to work A dam holds it back in Granby Reservoir a part of the unusual Colorado-Big Thompson project Pumps lift

A TRIP DOWN THE WILD COLORADO

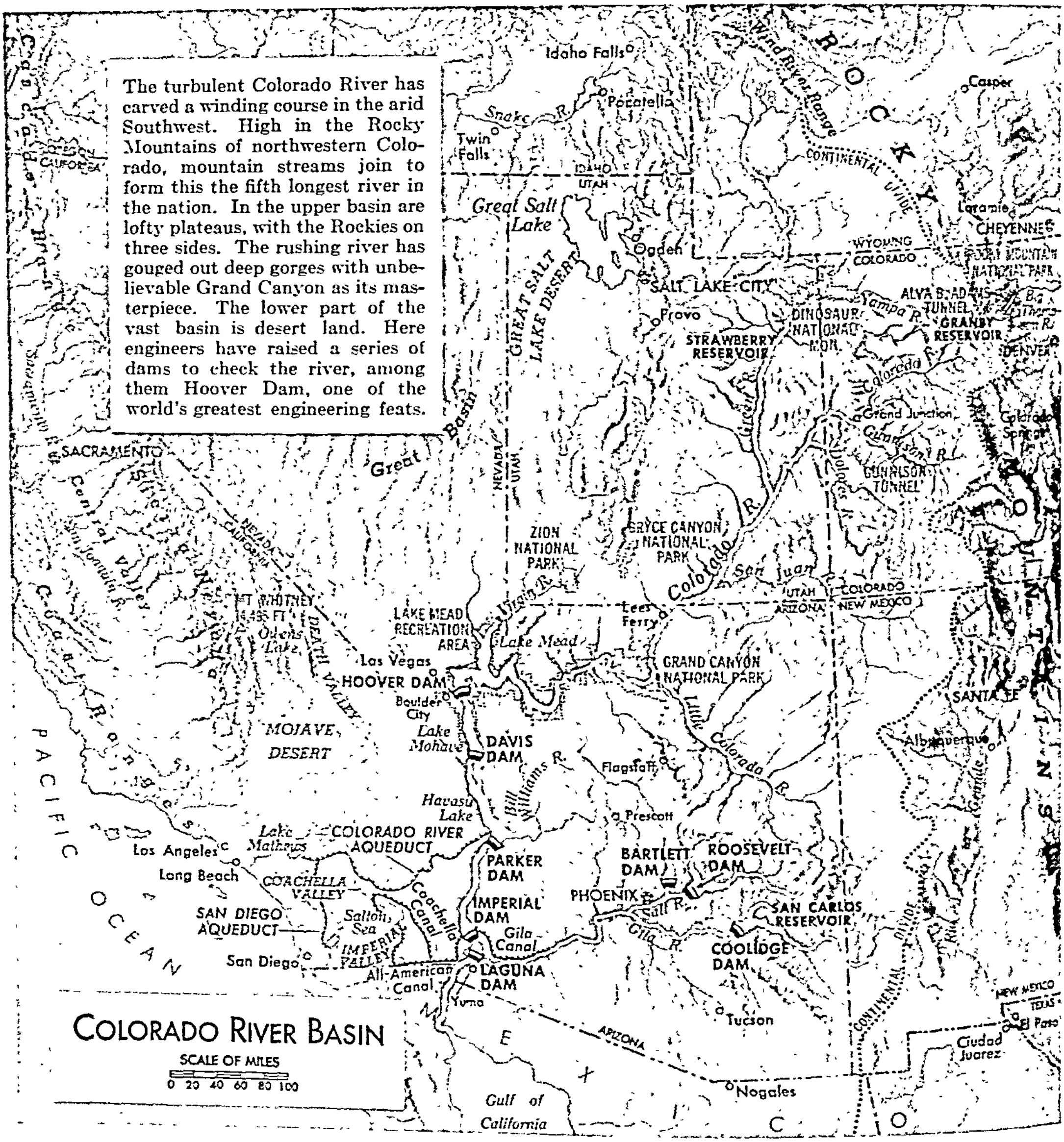
Here the Colorado and its chief tributary the Green River meet in Utah unrelentingly wearing away their high walled canyons

Like a sculptor s chisel the powerful Colorado has carved the fantastic Grand Canyon for more than 200 miles of its course



Where the Colorado flows between Arizona and Nevada high Hoover Dam holds the river back to form the great Lake Mead

The turbulent Colorado River has carved a winding course in the arid Southwest. High in the Rocky Mountains of northwestern Colorado, mountain streams join to form this the fifth longest river in the nation. In the upper basin are lofty plateaus, with the Rockies on three sides. The rushing river has gouged out deep gorges with unbelievable Grand Canyon as its masterpiece. The lower part of the vast basin is desert land. Here engineers have raised a series of dams to check the river, among them Hoover Dam, one of the world's greatest engineering feats.



water from the reservoir into Shadow Mountain Lake from which it flows into Grand Lake. Here is the Shadow Mountain National Recreation Area. The 13-mile Alva B. Adams Tunnel then carries the water through the Divide to the eastern slope. Lakes and other tunnels connect this, the world's longest irrigation tunnel, with the Big Thompson River to provide power and irrigation. The Colorado thus waters the South Platte Valley as far east as Nebraska.

Below Granby Reservoir, the Colorado receives the Blue River, held back upstream by Green Mountain Dam. At Grand Junction, Colo., the Colorado meets the Gunnison. In southeastern Utah the Dolores and Green rivers join it. The 730-mile Green River, the largest tributary, is longer than the Colorado above their junction. It rises in the Wind River Range in Wyoming. Above the junction with the Green, the Colorado was once called the Grand River.

In Glen Canyon the San Juan River merges with the Colorado. The river enters Arizona through majestic Marble Gorge. Here is Lees Ferry, the dividing line between the upper and lower basins.

Where the Little Colorado River pours into the Colorado, the river swings west through spectacular Grand Canyon (*see* Grand Canyon). Along its banks are Grand Canyon National Park and National Monument (*see* National Parks). Next to them is Lake Mead Recreation Area, a major tourist attraction. Lake Mead, 115 miles long, is on the Arizona-Nevada border. The Virgin River enters the lake through one

f its arms Hoover Dam (once known as Boulder Dam) creates this vast lake which stores more than a two-year normal flow of the Colorado (*see* Dam)

This dam is the key structure for development of the lower Colorado The Bureau of Reclamation finished it in 1936 A great engineering feat the dam controls floods and provides a stable water supply for southern California and southwestern Arizona It is one of the largest power plants in the world It also catches the tremendous load of silt carried by the river

The Colorado turns south and separates Arizona from Nevada California and Mexico Farther south are Lake Mohave and Davis Dam completed in 1949 for power and control of the discharge from Lake Mead

Along the Arizona California line is Havasu Lake and below the confluence of the Bill Williams and Colorado rivers stands Parker Dam built in 1938 The dam supplies power and irrigation water and diverts water through the 242 mile Colorado River Aqueduct and the 71 mile San Diego Aqueduct to cities in California (*see* Aqueducts Los Angeles) Downstream in California is the Palo Verde Valley irrigation district

Just before the Gila joins the Colorado is Imperial Dam Completed in 1938 it diverts water into Imperial Valley in southern California and to the Gila and Yuma projects in southwestern Arizona Laguna Dam built in 1909 controls Imperial Dam s tailwater

Imperial Valley is a fertile saucer below the river s level in the Colorado Desert Ages ago it lay beneath the Gulf of California but the river s delta cut it off from the gulf The Imperial or Alamo Canal completed in 1901 through Mexico tapped the Colorado for the valley In 1905 the river flooded the valley and converted a prehistoric sink into Salton Sea It took two years to control the break Hoover Dam now gives protection from floods

The 80-mile All American Canal the nation s greatest irrigation ditch carries water from Imperial Dam to the valley to make it a rich fruit and vegetable area A branch the 130-mile Coachella Canal supplies water to Coachella Valley northwest of Imperial Valley (*see* California)

The Gila River merges with the Colorado above Yuma On this tributary is Coolidge Dam and on its branch the Salt River are Stewart Mountain Mormon Flat Horse Mesa and Roosevelt dams Bartlett Dam is on Verde River feeding into the Salt

The Colorado then enters Mexico Here Morelos Dam completed in 1950 irrigates Sonoran Desert The river crosses its large delta through Hardy River and empties into the Gulf of California

Explored Early in the Nation s History

One of the early explorations of white men in North America was that of Colorado River Spanish conquistadors came from Mexico and found the Indians using irrigation Francisco de Ulloa reached the Colorado from the Gulf of California in 1539 but did not recognize it as a river In 1540 Hernando de Alarcón was the first white man to discover and sail up the river In the same year García López de Cárdenas of Coronado s party discovered the Grand Canyon (*see* Coronado) In 1776 Fathers Silvestre Vélez de Escalante and Francisco Atanasio Domínguez crossed the river in Glen Canyon Also in 1776 Father Francisco Garcés named the river *Colorado* (Spanish for red) for its red mud In 1857 Lieut Joseph C Ives navigated the Colorado from its mouth to Black Canyon Major John Wesley Powell made the first trip through the Grand Canyon

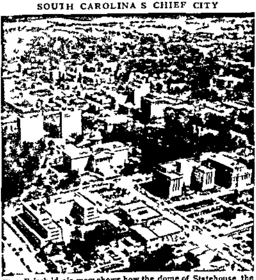
The division of the water among the seven states in the basin has been a difficult problem In 1922 these states agreed to the Colorado River Compact for apportionment of the water between the upper and lower basins The upper basin states divided their quota among themselves in 1949 The Mexican Water Treaty ratified in 1945 guarantees Mexico a water supply from the Colorado The International Boundary and Water Commission administers the treaty

COLUMBIA S C South Carolina s capital Columbia was established because the small farmers of the Piedmont (the higher country) wanted the seat of government removed from Charleston to the center of the state The low-country planters reluctantly agreed and in 1786 a site on the Congaree River was selected The legislators named the town Columbia

By 1795 the townsmen had built churches and established a newspaper and an academy In 1801 the legislature chartered the present University of South Carolina as South Carolina College Cotton manufacture still the city s main industry began in 1809

During the Civil War Columbia served the Confederates as a refugee center and manufactured munitions and currency In February 1865 General Sherman s Union Army took the city and about three quarters of it was destroyed by fire Only after Wade Hampton

SOUTH CAROLINA S CHIEF CITY



This Fairchild air view shows how the dome of Statehouse the Capitol Building dominates Columbia Capital of South Carolina since 1786 Columbia is also the state s largest city

was elected governor, in 1876, did economic recovery begin. Columbia is the headquarters for all state departments and for most of the federal agencies acting within the state. Besides the state university, it is the seat of a Lutheran seminary, a Bible college, a city college, and two colleges for Negroes. The capitol, called the State House, was begun in 1855. Two consecutive state fairs are held in October, the first for whites and the second for Negroes. The house in which Woodrow Wilson lived between the ages of 13 and 17 has been made a museum. Fort Jackson, an army post, lies five miles east of the city.

Columbia was incorporated as a town in 1805 and chartered a city in 1854. Its manufactures include cotton textiles, cottonseed oil, and ceramics. The council-manager form of government was established in 1950. *(See also* South Carolina.) Population (1950 census), 86,914.

COLUMBIA RIVER. The Pacific Northwest's greatest resource is the Columbia River and its tributaries. It is the largest source of hydroelectric power in North America. Its waters irrigate and make fertile vast areas of semidesert land. Grand Coulee Dam in north central Washington is the largest man-made structure on earth. Many other dams, from Bonneville on the Columbia's lower course in Oregon to Hungry Horse on a tributary in Montana, harness this great river for service throughout its basin.

The Columbia River rises in Columbia Lake in the Selkirk Mountains of southeastern British Columbia. It flows for 1,038 miles to the Pacific Ocean just below Cape Disappointment, in Oregon. About 460 miles are in Canada. The drainage basin of 259,000 square miles includes nearly the whole of Washington, Oregon, and Idaho, Montana west of the Rockies; and parts of Wyoming, Utah, Nevada, and British Columbia. (For drainage basin map, *see* United States)

Through the Cascade Mountains it slashes a deep and spectacular gorge. For about 330 miles on the Oregon side, from Pendleton to Astoria, runs the magnificent Columbia River Highway. At Mitchell's Point the road passes through a 385-foot tunnel, lighted by five openings which afford a glorious view of the river. The Evergreen Highway on the Washington side is also a scenic road of great beauty.

The largest tributary is the Snake River (1,038 miles long), which joins the Columbia from the east near the Oregon border. The second largest is Clark Fork-Pend Oreille (505 miles), entering above the Canadian border. The Yakima, Kootenay, Willamette, and Deschutes are other important tributaries.

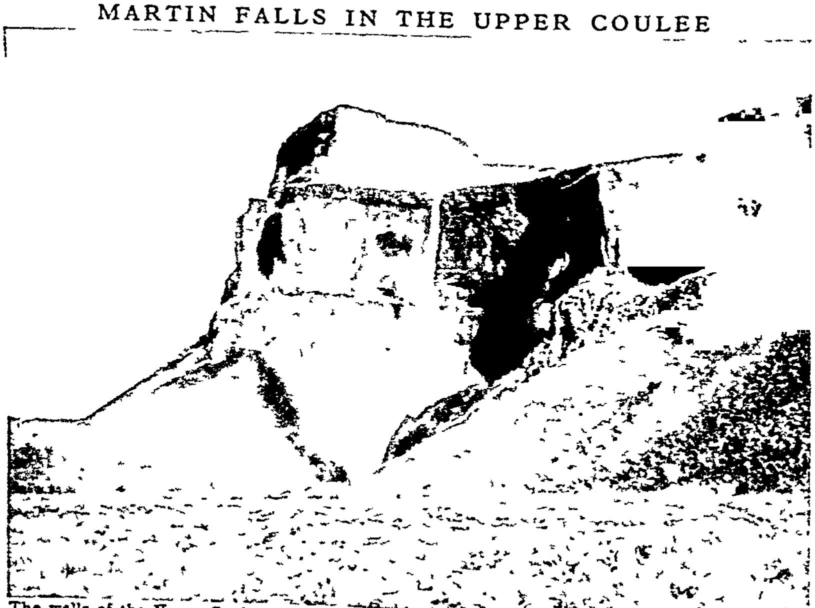
At the mouth of the Columbia, jetties force the river to cut a channel through a sand bar. Deepening of the lower river and of the Willamette permits ocean vessels to reach Portland, 113 miles inland. Upstream 155 miles is the Bonneville Dam, completed in 1937 for navigation and power at a cost of $40,000,000. It is famous for its fish ladders which permit salmon to travel upstream to their spawning grounds. (For pictures, *see* Dam; United States.) A canal lock at Bonneville enables ocean vessels to reach the city of The Dalles, 188 miles from the ocean. Above the dam are falls and rapids; but barges can ascend the Columbia and Snake rivers to Lewiston, Idaho

Hydroelectric Power and Irrigation

The Columbia River discharges nearly 160 million acre-feet of water a year. Much of the water falls 1,290 feet from the Canadian border to tidewater. The potential water power is 40 million horsepower. This is about one third of the potential water power of the entire United States. The whole basin depends on water power for industrial development, for it has no coal or oil. The Atomic Energy Commission's plutonium plant at Hanford, Wash., and new aluminum and other electrochemical and electrometallurgical industries have grown up in the valley to use this power. The Bonneville Power Administration distributes the electricity generated by several dams and power plants, including Grand Coulee (*see* Electric Light and Power).

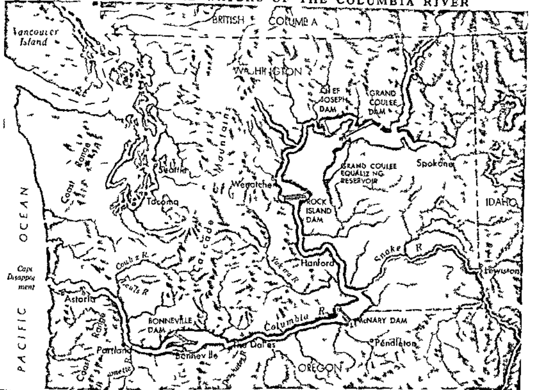
The peak flow of the river comes in summer, usually in June, from melting mountain snow. Summer floods are not uncommon. One of the worst, in June

MARTIN FALLS IN THE UPPER COULEE



The walls of the Upper Coulee are usually dry, but in the early summer excess water draining from the plateau above pours over the edge of the Coulee, forming many beautiful waterfalls.

HARNESSING THE WATERS OF THE COLUMBIA RIVER



This profile view shows the dams on the main stream built to harness the mighty Columbia River for electric power irrigation transportation and flood control Many others are proposed or under construction on the Snake and other tributaries Most distant and beyond the range of this map is the Hungry Horse Dam in northwestern Montana

1948 almost completely destroyed the town of Vanport Ore near Portland In winter with the river s sources frozen the flow is at its lowest The high summer flow provides surplus water for irrigation and for power to pump water into irrigation canals Most of the land now under irrigation lies on the Snake River plain of southern Idaho (70 per cent) and in the Yakima Valley of Washington the Deschutes and Willamette valleys of central Oregon and the Bitter root Valley of western Montana

Grand Coulee Dam

Grand Coulee Dam completed in 1942 at a cost of $183 000 000 is 597 miles upstream in northeastern Washington It is the world s largest dam and the world s greatest single source of hydroelectric power (*see* Dam) The reservoir behind the dam known as Franklin D Roosevelt Lake extends 151 miles to the Canadian border and has an area of 85 000 acres The National Park Service administers its 600-mile shoreline as a National Recreational Area

The dam was built to generate power and to supply water for irrigation to the Grand Coulee a curious feature of the lava plateau south of the dam During the last Ice Age glaciers blocked the normal flow of the river below the dam site two or more times and forced the water to flow southward over the plateau There it cut a wide gorge called the Grand Coulee Two huge waterfalls formed the Upper and the Lower Coulees These Coulees lie 280 feet above the level of the present dam and reservoir Until the 1950 s they were dry and the surrounding country arid

In order to irrigate more than a million acres of the land on the plateau the Upper Coulee is dammed at either end Water is pumped 280 feet up through a tunnel in the granite walls of the canyon through which the present Columbia flows The water then goes through a canal into a 27 000-acre equalizing reservoir which floods the Upper Coulee In 1952 water began to flow from the reservoir through 4 000 miles of canals to irrigate the land

The various dams locks canals and power plants throughout the Columbia basin are being constructed by the United States Bureau of Reclamation which is concerned with irrigation and the Army Corps of Engineers concerned with navigation Congress has considered various proposals to entrust the long range development of the entire basin to a single body the Columbia Valley Administration similar to the Tennessee Valley Authority

Discovery of the Columbia

A Spaniard Capt Bruno Heceta sighted the estuary of the Columbia in 1775 but did not enter it

In 1792, Capt. Robert Gray, the Yankee skipper of the ship *Columbia*, crossed the treacherous sand bar at the mouth of the river—the first man to accomplish this. In honor of his ship he changed the river's name from "Oregon" to "Columbia." Later, Sacagawea, the "Bird Woman," led Lewis and Clark to this river, and they explored it in 1805–6.

COL'UMBINE. Some nature lover thought the petals of this dainty flower looked like tiny doves. He named it columbine, from the Latin word *colombinus*, meaning "dovelike." It prefers rocky ledges and woodlands where the soil is thin. The blossom hangs head downward, and the slender stem arches with its weight. The slightest breeze sets the delicate plant bowing and nodding.

WILD AND GARDEN COLUMBINES

The wild red and yellow columbine has graceful hanging flowers. Notice the backward-curving hollow tubes which hold the nectar, and the tasseled stamens and pistils. A cultivated beauty is pictured at the right.

The blossom is one to two inches long. The five petals curve backward into a hollow tube tapering to a slender round-tipped spur. The five flaring sepals are colored like the petals. The long stamens and pistils form a golden tassel that extends beyond the tips of the petals. The stem is one to two feet high. The leaves are light green above and whitish underneath, dividing into three or more rounded lobes. The nectar is in the spurs of the petals. Only the long-tongued bumblebee and the humming bird can reach it. Some of the smaller bees rip open the ends of the spurs.

The common American columbine is scarlet on the outside and yellow inside. It occurs throughout the eastern half of the United States and Canada. (For illustration in color, see Flowers.) On the west coast is a similar species but it grows over three feet high and has fewer blossoms. The Rocky Mountains, from Montana to Mexico are the home of the blue columbine, the state flower of Colorado. The white columbine, sometimes tinted with blue, grows in the mountains of the Northwest. The cultivated hybrids are favorites in rock gardens.

The columbines form a genus (*Aquilegia*) of the Crowfoot family (*Ranunculaceae*). Scientific name of the common American columbine, *Aquilegia canadensis*; blue columbine, *Aquilegia caerulea*. There are about 50 species in the northern hemisphere; about 30 are native to North America.

The GENOESE WHO FOUND *the* NEW WORLD

COLUMBUS, CHRISTOPHER (1451–1506). On the morning of Oct. 12, 1492, Christopher Columbus stepped ashore in America. It was one of the most important landings in history. Until then, Europeans knew nothing of America. But from that day on, America became a part of the civilized world.

Columbus' history-making voyage from Spain to America was unusual in two ways. For one, Columbus was not the first white man to see America. About 500 years earlier, small groups of Northmen made brief visits to the American coast. But nothing came of their stay, and later Europeans did not know of them. Columbus made his voyage just as though no white man had ever seen America before.

Another unusual feature was that the discovery was an accident. Columbus was seeking a western sea route from Europe to Asia. When he sighted America, he believed that he had reached his goal. And to the day he died he still believed that he had reached Asia. Although Columbus was mistaken, he still ranks as a great discoverer. Only his magnificent seamanship and powerful leadership could have made possible the long voyage over the unknown ocean that men called the "Sea of Darkness."

Early Life of Columbus

The father of Columbus was Domenico Colombo, a wool weaver. He had his own business in the port city of Genoa, Italy. There Cristoforo was born in late summer or early autumn of 1451. (English-speaking peoples have since changed the Italian form of his name to Christopher Columbus.) The boy had little or no schooling. He and his younger brother Bartholomew helped their father by carding raw wool.

Christopher grew up to be a tall, strongly built young man with red hair and a ruddy complexion. He was quiet and deeply religious; and he was quick to learn from experience. He worked for his father until he was 22, but he probably went to sea many times before then. As other Genoese boys did, he doubtless went out with the sardine fishing fleets, and he may have sailed along the coast or over to Corsica on business for his father. Genoese traders often owned their own coastal schooners, and Columbus' father may have had one of these. He made at least one trip to

e North African coast On these longer voyages he arned the elements of seamanship

Portugal and a New Life

In 1476 Columbus sailed as a common seaman aboard Genoese merchantman bound for Lisbon England nd Flanders Many Mediterranean nations were at ar and so the ship traveled in convoy Off the south oast of Portugal the convoy was attacked and Co-mbus' ship went down He swam ashore and made s way to Lisbon Genoese friends took him in and ter found him a berth on a ship bound for Iceland n his return he settled in Lisbon

At this time Portugal was the world s greatest sea-ring nation A half century l efore l ortugue e n ar ers began making important voyages ol d scove y nder the sponsorship of Prince Henry the Navigator *ee* Henry the Navigator) Many nat ves of Genoa ad prospered in Lisbon and Columbus sa v hi chance become a sea captain under the Portuguese flag

But first he had to lucate himself He *arned to speak and* ad Portuguese and astilian (the official nguage of Spain) and e mastered Latin so e could read schol rly books on geogra hy He learned as uch navigation as was nown at that time

To earn his living he ecame a chart maker e also made at least ne voyage as agent or a Genoese merchant 1 Lisbon In 1479 he arried Doña Felipa erestrello whose ather had been one of rince Henry s cap ains They had one on Diego Fel pa s igh social rank enabled Columbus *to meet im* ortant officials She ave him her father s collection of charts and docu ents and from these Columbus ga ned more knowl dge of Portuguese discoveries and plans In 1481 he ntered the service of King John II of *Portugal and* oyaged to the Gold Coast of Africa

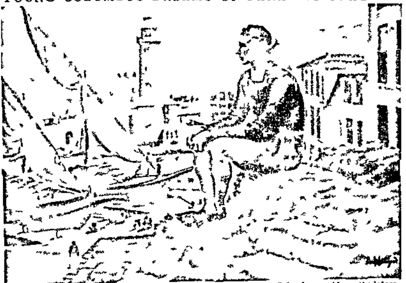
Lands to the West

The wealth of Asia had been trickling into Europe or more than 200 years and Europeans were eager for nore of it But goods had to come by a perilous over and route which made them scarce and expensive h ps could carry goods more *cheaply and* in greater uantity To reach In l a China Japan and the East nd es the Portuguese were already probing for an astern sea route around *Africa Another* possibility was a western sea route across the Atlantic and be-yond All e lucated men knew that the world was spherical and that Asia lay west of Europe The ques-tion was how far?

Columbus thought he knew the answer But his stud es led him to accept two errors that the earth s circumference was much smaller than it is and that the land mass of Asia extended much farther than it does He drew his calculations from scraps of evidence in such sources as the Bible tl e writ ngs of Marco Pol and Pierre d Ailly s Imago Mundi (Picture of the World) He took the information that supported l is belief and rejected everything else

Other men had ma le s m l ir calculations but none ha l figure l so opti m t cally Supporting Columbus vie vs were a number of sa lors yarns about lands sighted n the Atlantic Ocean More concrete evi dences were pieces of carved woo l and unknown types of cane and beans found drift ng beyond the Azores Columbus was sure that nothing but a few already

YOUNG COLUMBUS DREAMS OF FARAWAY PLACES



From a h gh place ove look ng the Genoa harbor young Chr stopher Columbus could see the lateen r gged oastal schooners below Here he may have sat look ng out to sea and dream ng of the time when he could command a ship on the *blue Med terranean* and perhaps on the unknown seas beyond

known islands lay between Europe and Asia He was determined to prove that Asia could be reached by sail ng about 3 000 miles west

Columbus Seeks a Backer

In 1484 Columbus applied for ships and men from King John II of Portugal The king s committee de cided that his plan was unsound and the application was refused Meanwhile Columbus wife had d ed Taking his son Diego he journeyed to Spain to seek backers He left Diego in the care of the Franciscan friars at the monastery of La Rábida

In Spain Columbus made a number of influential friends who helped him present his plan to King Fer-dinand and Queen Isabella At the time they were busy conducting a war against the Moors in Granada, but

COLUMBUS PRESENTS HIS PLAN TO THE ROYAL COUNCIL

In 1486 Columbus, aided by Father Diego de Deza, presented his plan for sailing west to Asia before a committee appointed by Ferdinand and Isabella. The committee, headed by Father Hernando de Talavera, the queen's confessor, met at St Stephen's College at the University of Salamanca. Both sides argued over the distance to Asia, but the committee could not reach a decision. Here Columbus sits discouraged after the hearing, knowing that the committee is against him.

they appointed a commission to examine Columbus' proposal The commission postponed making a decision and Columbus was left waiting, although he was placed on the royal payroll. In Cordova Columbus took Beatriz Enríquez de Harana as his common-law wife. They later had one son Ferdinand (Fernando).

King John invited Columbus to return to Portugal. But during the second review of his plan, Diaz returned from discovering the Cape of Good Hope at the southern tip of Africa (*see* Diaz). This meant that a route to India was open, and the Portuguese were no longer interested in an unproved western route. Columbus returned to Spain to try again.

Finally after the fall of Granada in January 1492, the Spanish sovereigns agreed to finance the expedition. They promised to make Columbus Admiral of the Ocean Sea and viceroy of all islands and continents if he should succeed.

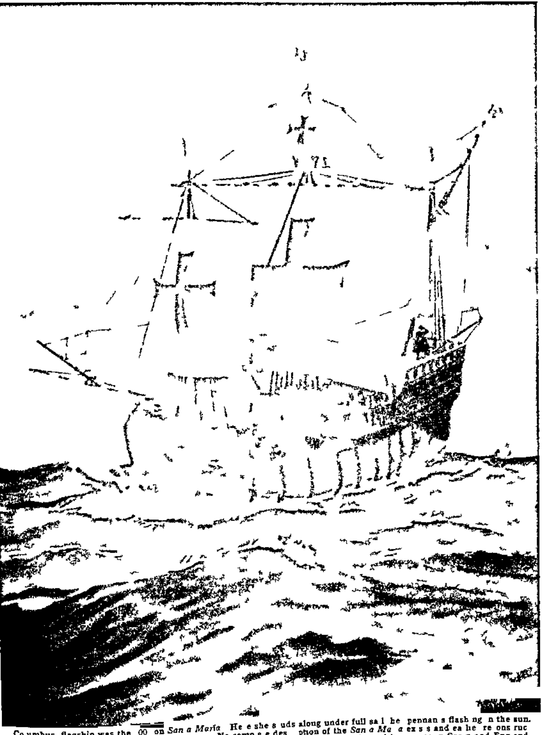
The harbor town of Palos had offended the Spanish rulers, and as a penalty they ordered the town to furnish two ships for the expedition. These were the *Niña* and the *Pinta*. A third ship, the *Santa María*, was chartered. Columbus commanded this vessel himself; he selected two Palos captains to lead the other ships. The crews were recruited in Palos.

The Momentous First Voyage

At dawn on Aug 3, 1492, the three ships hoisted anchor in the Palos harbor and got underway. Only three days out of Palos the *Pinta* lost its rudder, and the *Niña's* lateen rig proved unsuitable. Columbus had planned only to load fresh provisions and water at the Canary Islands. But he stayed to install a new rudder on the *Pinta* and square rigging on the *Niña*. On September 9 they left the Canaries and spread their sails. Steady trade winds from the northeast drove them on their course. With proper setting of sail and rudder they were carried due west.

As they sailed westward Columbus kept two records of progress One was the distance he thought they had actually traveled; the other was a much shorter estimate that he showed the crew. This was to quiet their fears at being so far from home. But the false record was nearer to the actual mileage than Columbus' secret estimates. Columbus' mistakes were common to the times. His navigation instruments were crude; and like most captains, he had little practise in their use.

For the most part the passage was smooth and the winds were steady. But as the days passed the men could not see how they could sail home against winds that had blown them steadily west. About midway in the voyage the seamen noted that the compass varied to the west of true north. They were familiar with the easterly variation experienced in the Mediterranean, but this change was new and fearful (*see* Compass). A falling meteor and the thick-growing plants of the Sargasso Sea increased their fear.



Columbus' flagship was the 100 ton *Santa María*. Here she scuds along under full sail, the pennants flashing in the sun. The *Niña* and the *Pinta* follow on the horizon. No complete description of the *Santa María* exists and early reconstructions differ. This picture by Paul Strayer follows closely the latest researches of naval historians in Spain and England.

On October 8 and 9 the men were ready to rebel. Columbus had to agree to turn back if land was not sighted within three days.

On October 11 the *Pinta* fished up a piece of bamboo, a pole, a board, and a stick that seemed to have been shaped by tools. At 10 o'clock that night Columbus himself thought he saw lights. At 2:00 A.M. on October 12, Rodrigo de Triana, a seaman aboard the *Pinta*, cried loudly the first sight of the New World. The voyage from the Canaries had taken 33 days.

Landfall in the New World

The little Spanish fleet had sailed among the Bahama Islands. The first land sighted Columbus named San Salvador (now called Watlings Island). Its Indian name was Guanahani. The ships' boats were put over the side and Columbus, accompanied by officers and crewmen, landed. With them they carried the royal banners of Ferdinand and Isabella. They were met by a band of curious but peaceful natives. The Spaniards knelt on the sand and gave thanks to God for the safe and successful voyage. Then, while the natives watched, Columbus took possession of the island in the name of the king and queen of Spain. The crewmen, now delighted with the discovery, begged Columbus' forgiveness for their disobedience.

The natives were friendly and helpful. Columbus, believing San Salvador to be an island of the Indies, called them Indians. At once the men began trading with the Indians, offering hawks' bells and glass beads for the Indians' ornaments.

Sailing on, Columbus stopped at islands he named Santa María de la Concepción (now Rum Cay), Fernandina (Long Island), and Isabela (Crooked Island). He then sailed south to the north coast of Cuba. He named this island Juana for the Spanish prince.

Everywhere he asked the Indians where gold could be found. On Dec. 6, 1492, he reached the north coast of Hispaniola. Previously he had found small trinkets of gold, but here the natives told of a gold mine in the interior of the island. Early Christmas morning the *Santa Maria* went aground off Cap Haitien. Before it could be worked off, its bottom was so badly torn that the ship had to be abandoned. From its timber Columbus built a small fort, La Navidad. The sailors, excited by stories of gold, begged to be left as colonists. Columbus selected 39 to stay.

Triumphant Return to Spain

On Jan. 16, 1493, the *Niña* and the *Pinta* began the return voyage. They carried gold, bright-feathered, colored parrots, other strange animals and plants, some Indian cloth and ornaments, and several Indians. A stormy eastward passage separated the two ships and did much damage. Columbus, on the *Niña*, was forced to put in at Lisbon for refitting. The *Pinta* made port at the Spanish town of Bayona, to the north of Portugal. In Lisbon, Columbus was welcomed by King John. With repairs completed, Columbus sailed. At midday of March 15, 1493, the *Niña* dropped anchor in Palos harbor. The *Pinta* made port later the same day.

The court was at Barcelona, and the Spanish king and queen welcomed Columbus there. To the court Columbus took six of the Indians, the gold, and some of the plants and animals. The sovereigns rose to greet Columbus and seated him at their right. All honors

COLUMBUS RETURNS TO SPAIN IN TRIUMPH

Before the royal court at Barcelona, Columbus presents his New World treasures—gold ornaments, trinkets, crude weapons, flowers, plants, and Indians clad in barbaric trappings. These were undeniable proofs of the new lands that lay across what men once called the "Sea of Darkness." This was Columbus' greatest hour. Never again did he receive such acclaim and respect.

and titles promised him were confirmed This was the height of Columbus' glory

Columbus made three more trips to the New World 1493–96, 1498–1500, and 1502–4 On the second he commanded 17 ships and about 1,200 men, many of whom became colonists on Hispaniola

At Hispaniola, Columbus found La Navidad burned and the 39 seamen slain A new colony was started The colonizers quarreled, and their harsh measures made the Indians unfriendly On this voyage Columbus explored the coasts of Jamaica and the southern coasts of Cuba and Hispaniola

On the third voyage Columbus first sighted Trinidad and explored some of the northeastern shore of South America and the Leeward Islands Some disgruntled colonists had returned to Spain and aired their dissatisfactions before the court A new governor was sent to replace Columbus He arrested Columbus and returned him to Spain in chains Isabella and Ferdinand ordered Columbus released and restored his titles But they forbade his landing on Hispaniola on his fourth voyage, unless he needed supplies for his return trip

CHRISTOPHER COLUMBUS

No authentic portrait of Columbus exists This is how Daniel Huntington imagined he looked

The purpose of the fourth voyage was to discover a strait that would permit passage to Asia In this Columbus failed He explored the east coast of Central America but lost two of his ships The two remaining were in such poor condition that Columbus ran them aground on Jamaica in June 1503 There he and his men waited for help Messengers sent by canoe to Hispaniola finally brought rescue ships in June 1504 and Columbus returned to Spain

Columbus' Last Years

Columbus was broken in health and spirit He was not received at court But he did not suffer hardship He had brought back considerable gold from his last voyage, and his share of gold from Hispaniola continued to be paid him He felt badly used however, by King Ferdinand's failure to restore to him the viceroyalty of Hispaniola To the day of his death, May 20, 1506, he begged the king to restore his privileges and honors

About 1541 the bodies of Columbus and his son Diego were removed from Seville to the Cathedral of Santo Domingo on the island of Hispaniola In 1795 the Duke of Veragua, Columbus' descendant, took to Havana a box believed to contain the bones of Columbus In 1899 this was removed to Seville *But in* 1877, in the Cathedral of Santo Domingo, another box bearing the Admiral's name had been found Today most Latin Americans believe that the box taken to Seville contained the remains of *Diego So both the* Old World and the New claim the bones of Columbus

COLUMBUS, OHIO Ohio had been a state since 1803, but it had no permanent capital In 1812 the Ohio General Assembly decided to place the capital near the state's center It chose a site on the east bank of the Scioto River, near its junction with the Olentangy, and named the new town Columbus This has grown to be the third city of the state and one of its chief industrial centers

At the intersection of High and Broad streets, the principal thoroughfares, stands the Statehouse a Greek Revival building of native limestone, completed in 1861 At the entrance of the ten-acre grounds stands a memorial to President McKinley Near by is a monument to Ohio soldiers and statesmen

Two blocks to the west, the winding Scioto forms an oxbow Here is the civic center, completed between 1928 and 1936 Its buildings include the Ohio State Office Building, the City Hall, the United States Post Office, and the Safety Building, which houses the police and fire department headquarters, the city prison, and the municipal courts Near by is the Le Veque-Lincoln Tower

Ohio State University has a 400-acre campus on the Olentangy River Its College of Education supervises the University School, a widely known laboratory school At the main campus entrance is the Library and Museum of the Ohio State Archaeological and Historical Society Its exhibits record the human and natural history of Ohio from prehistoric times The Battelle Memorial Institute conducts research in metallurgy, fuels, and allied fields The Columbus Gallery of Fine Arts has a collection of works by George Bellows, Columbus' most noted artist

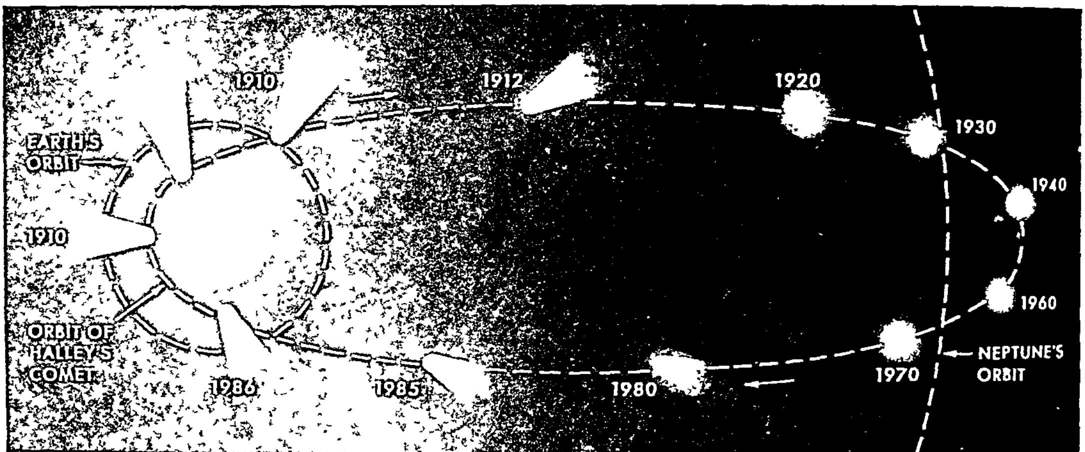
At Columbus are the Ohio State Penitentiary and state institutions for the deaf, the blind, and the feeble-minded *Fort Hayes is headquarters for a military area of the United States Army and the Ohio National Guard* East of the city is the Columbus General Distribution Depot of the Army, occupying 225 acres, *and Port Columbus, the municipal airport*

Nearness to fuel and limestone, rich farms, and five railroads make Columbus a leading industrial and commercial center Chief manufactures include airplanes *railroad cars, and* automobile parts, mining, road, and oil-well machinery, iron and steel products, shoes, oilcloth, packed meat, and glass products

In 1797 Lucas Sullivant, a Virginia surveyor, established a settlement on the west bank of the Scioto This town, Franklinton, was later absorbed by Columbus

Columbus was incorporated as a borough in 1816 and as a city in 1834 The Ohio and Erie Canal (1831) and the first railroad (1850) stimulated the city's growth Population (1950 census) 375 901

HOW HALLEY'S COMET MOVES IN ITS ORBIT



Halley's comet was last seen in 1910, but undoubtedly it will be seen again in 1986. This picture shows why. The comet moves along its oval orbit around the sun. This path is inside the earth's orbit at one point, and beyond the orbit of the planet Neptune at the other extreme. The comet moves swiftly as it approaches the sun, but it slows down in the outer portion of its orbit. Notice how the tail begins to form as the comet approaches the sun and how it disappears as the comet travels away.

COMET. Until modern times, the appearance of a comet sent people into shivers of fear. They thought that it was a warning of war, plague, or other disaster. Today few people have such superstitious fears, because we know that comets are as natural as the sun, the moon, and the stars.

A comet has a bright head and, when it comes near the sun, a glowing tail. The head itself may range from 30,000 to 150,000 miles in diameter. The head contains solid matter, from bits as fine as dust to pieces weighing many tons, and also gases. But the solid matter is small compared to the volume of a comet. Small stars shine through a comet without loss of brilliance; and comets are actually invisible against the face of the sun.

Whenever comets approach the sun, they encounter pressure from the sun's light. This pressure drives gases and particles out from the head in a tail, which may be many millions of miles long.

The Motions of Comets

Comets move through space in orbits influenced by the attraction of the sun and other stars. Those which pass near enough for us to see probably fall into orbits around the sun. Some orbits, however, reach so far into outer space that we cannot tell when the comet will return. When we can predict the return, we call the comet *periodic*.

This periodic motion was discovered in 1704, when the astronomer Edmund Halley (1656–1742) predicted that a bright comet seen in 1682 would return about every 75 years. It has done so, down to its latest appearance in 1910. Notable earlier appearances were in 1066, when William of Normandy conquered England, and in 451, when Attila the Hun and his hordes were defeated by the combined forces of Romans and Visigoths under Aëtius in the battle of Châlons. Historians have traced its regular appearance as far back as 204 B.C. The picture above shows that it will most likely appear again in 1986.

Uninformed people fear disaster if a comet should strike the earth or sweep its tail through the atmosphere. But in 1910 the earth passed through the tail of Halley's comet without harm. A comet's head is scarcely more dangerous. History has no record of any comet damage done to the earth.

When a comet passes near a planet, the planet's pull changes the orbit, and the amount of change gives a clue to the comet's weight. A comet's head is often broken up by the attraction of the sun or a planet. Then the head becomes merely a swarm of meteors traveling in the old orbit (*see* Meteors and Meteorites). Comets may also lose their tails. Then they show only the glowing envelope, called a *coma,* around the bright part, or *nucleus,* of the head. Comets never recover matter lost from the head or tail.

Almost every year several comets which have huge orbits are sighted for the first time. Watching for these "new" comets is a favorite hobby of amateur astronomers, and professional astronomers rely largely upon amateurs for this work. The total number of observed comets is about 1,000. Astronomers learn the composition of comets by examining their light with spectroscopes (*see* Spectrum). This light comes partly from reflected sunlight and partly from a glow emitted by gas molecules.

Our word "comet" comes from the ancient Greek name *kometes,* meaning "long-haired." Comets may be named for the discoverer or the year of discovery. Letters after a given year show the order of discovery within the year; Roman numerals mean the order in which comets approach the sun.

COMMERCE. All over the world people and nations sell their surplus goods and buy what they cannot produce themselves. This exchange of commodities is called commerce or trade. The term commerce comes from the Latin words *com* ("with") and *merx* ("merchandise"). (*See also* Trade; International Trade.)

How COMMUNICATION *Helps Us* LIVE *Together*

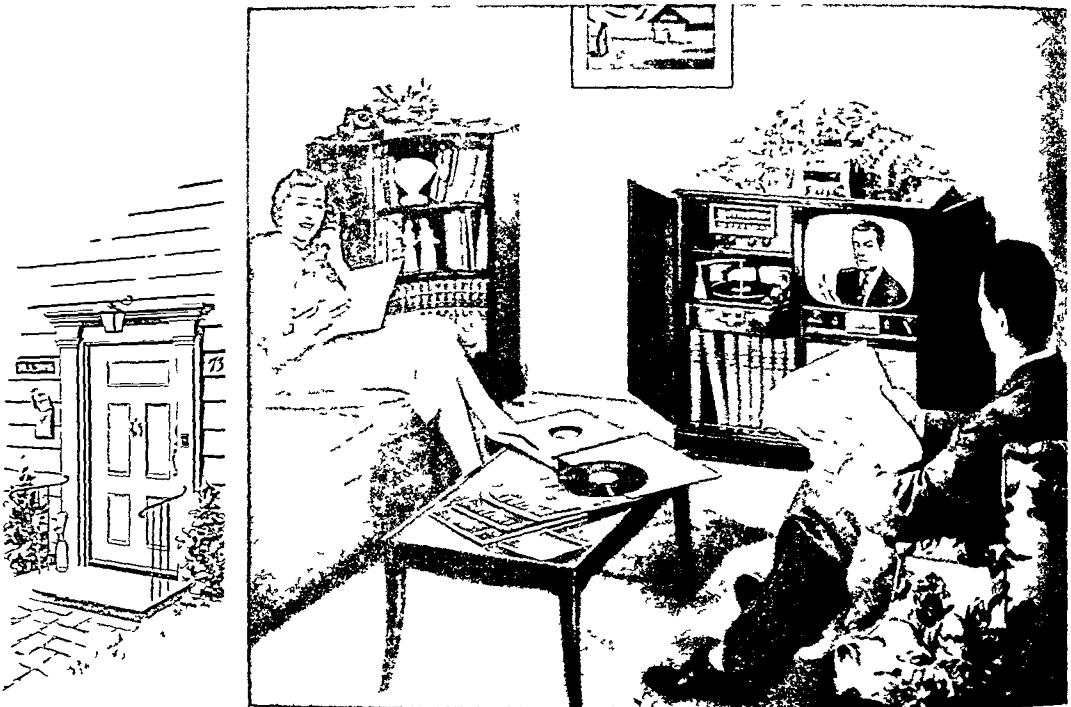
Here an American government official makes a speech that may affect the lives of people everywhere Radio and telegraph flash his words to foreign capitals Within the United States television and radio bring his speech directly to eager audiences Soon newspapers and newsreels carry the message Bringing people the news is one of the most vital uses of communication

COMMUNICATION As you walk down the street you may see a friend and say Hello A little farther on you may hear a cry for help Both the friendly greeting and the call for help are messages from one person to another All such transfers of ideas between people are *communication*

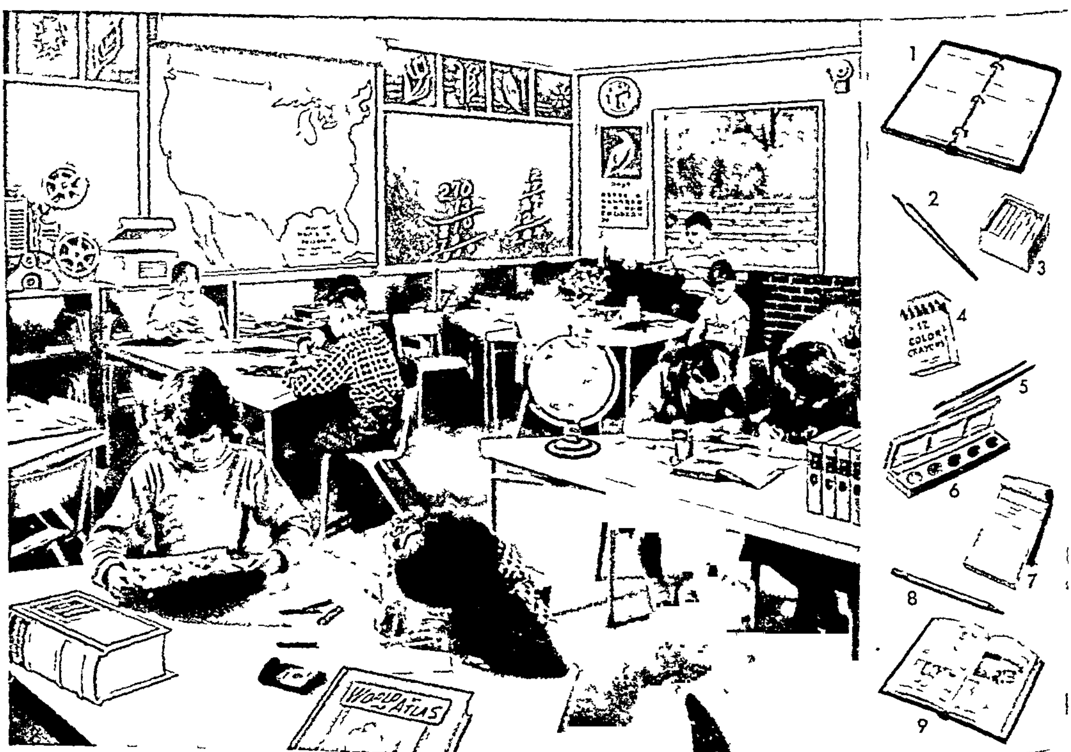
Speaking is only one of the many ways we can communicate We can also put words down on paper and send them to another person by mail or telegraph Printed words in books and newspapers can reach thousands or millions of people Another form of communication is the picture With a picture an artist or photographer can show others what he has seen or imagined Even a wave of the hand in greeting is a communication So is a train whistle or a stop sign

All these different ways suggest how often we use communication It is one of the most important things in our lives and we need it just as we need food clothing shelter and transportation Communication is necessary for living together in communities

The close connection between *communication* and living together in *communities* is emphasized by the words themselves Both of them came into the English language from the Latin word *communis* meaning in common or shared In order to live in a community we must share goods and services with each

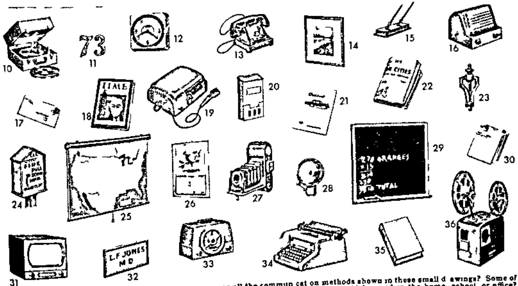


The pictures on these two pages show some of the many communication methods a family will use every day. At home, for example, members of the family communicate with each other and with outsiders constantly. How many methods are shown in this picture of a front doorway and living room? Does the family have any other methods it can use in other rooms of the house?



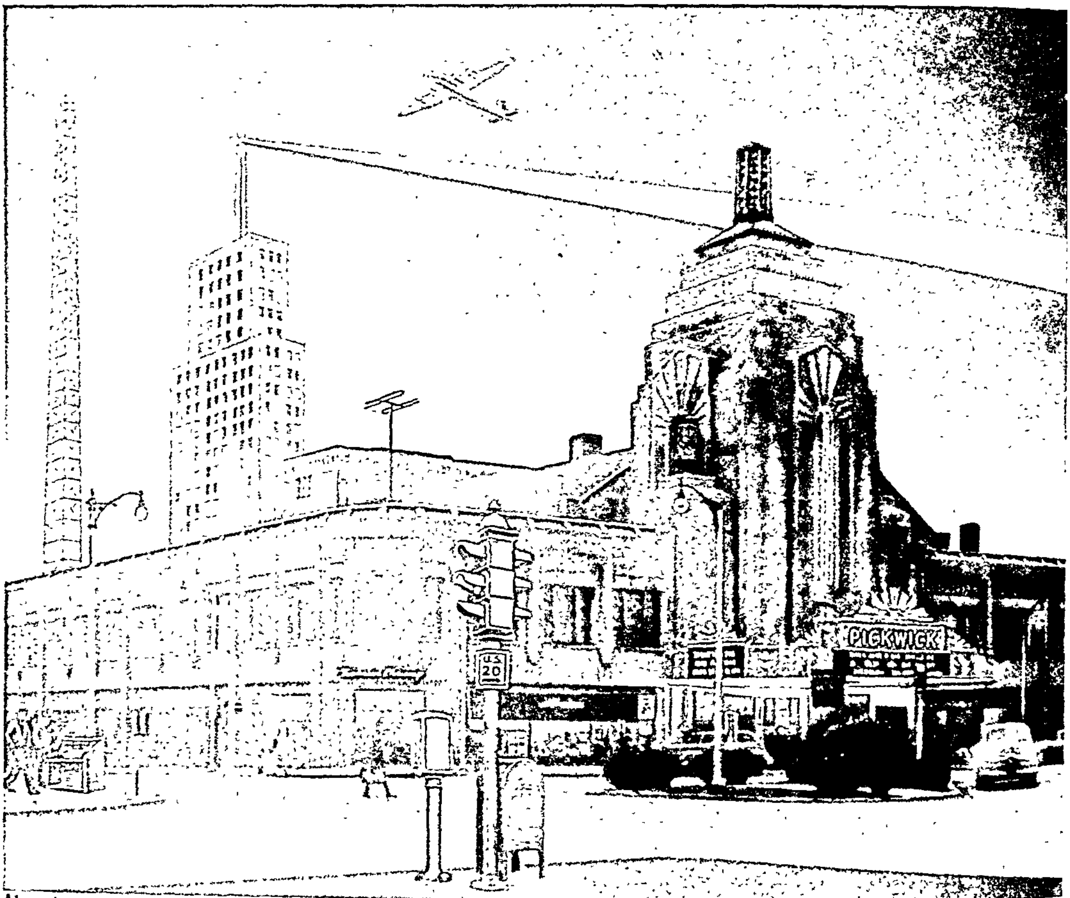
In school the teacher communicates whenever she conducts a class. The pupils in turn recite, write compositions, and make various kinds of pictures to show what they are learning. All these activities are forms of communication. How many communication methods are being used in this picture? Do teachers and pupils use other methods not shown in this picture?

The manager of a small factory exchanges messages with customers, gives orders to factory workers, and keeps many kinds of business records. His secretary helps him in all this work. These activities make the manager's office a communication center for all factory work. How many different communication methods are being used in this picture?



Here is a kind of communication quiz game. Can you name all the communication methods shown in these small drawings? Some of them show plainly in the big pictures, but others do not. Can you tell where they could be used in the home, school, or office? (Names of the methods are given in a box on a later page of this article.)

COMMUNICATION METHODS AT WORK OUTDOORS



Almost any street intersection near the center of a town shows many examples of communication methods. At this corner, for example, the methods include a radio tower, an airplane beacon guiding a mail plane, a public-address system on top of the theater building, store window and theater signs, road signs and traffic signals, and police call boxes and mailboxes. Others can be seen if you look closely. All these means of communication help people to live and work together in a community.

other. But as we share these things, we must also exchange facts and ideas, make plans, and come to agreements on how to run our community.

Why Communication Is Important

The word "communication" thus covers all the ways we have of telling things to each other or to the world at large. Modern methods have speeded up communication, and today people living in communities and even out in the country depend on this speed. One of the swift methods we use most often is the telephone. Without it, much of our community life would be slowed down. People would have to use slow and roundabout ways to exchange ideas, unless they could talk face to face. If a fire broke out, someone would have to drive or run for blocks or even miles to notify the firemen. The same dangerous delay would occur in meeting any similar sudden need.

If only one method, the telephone, is so important, think of what help we get from all modern methods, taken together. This account tells some ways that one family uses communication throughout the day (the italicized words are communication activities):

At breakfast the Jones family *listens* to the *weather report* on the *radio*. They *discuss plans* for seeing a *movie* the next evening. Before Tom Jones leaves for school, his mother *writes* a *note* to his teacher, explaining his absence the previous day. Tom *calls* his friend Jim and the two walk to school. On their way they see a *sign* on the *billboard advertising* a new *play* at the Little Theater.

Mr. Jones glances at the morning *newspaper* before leaving for work. Mrs. Jones makes out her grocery *list*, then *telephones* the grocer. When her morning's work is done, she *mails* an anniversary *card* to a friend and later continues *writing* her *speech* for the Women's Club *forum*.

At his office Mr. Jones reads his *mail* and *dictates replies* to his secretary. He *telephones* the factory he represents and *wires* several customers about their *orders*. To one overseas customer he sends a *radiogram*. He *studies* business *reports*, and several times he scans the stock market *ticker tape*.

In geography class Tom *studies* the Mississippi River in his *textbook* and *recites* when the teacher *calls* on him. On a *map* he traces the river's course; and he makes a *graph* showing the river's yearly rise and fall. In the afternoon Tom's class goes to the assembly hall and listens to a *speaker* tell of his trip to the Far East. The speaker *shows slides* of his journey.

After school Tom and Jim practise *sending* and *receiving Morse code* for their Boy Scout test. During the evening Tom

writes a composition for his English class. Mr. Jones develops *photographic negatives* and *prints pictures* in his darkroom, and Mrs. Jones *watches a television program*. Before going to bed, the family *listens to a radio news report*.

People Who Give Us Communication Service

These examples include many ways of communicating over a distance with one or many people. Every such method needs a number of people to make it work. Some of these people we see or hear daily. Postmen, telephone operators, and radio announcers are among them. Other communications are provided by people we usually do not see. Among these are sign painters, photographers, and printers. Working with all these people are business helpers—clerks, bookkeepers, and messengers. All do their share *in providing communication*.

The daily newspaper shows how many different workers may be needed to provide one kind of communication. Reporters and photographers gather the news in words and pictures. In the editorial offices editors, rewrite men, and copyreaders turn the news facts into articles. Linotype operators set the article in linotype slugs, and engravers make half tone engravings from the photographs. Make-up men gather the type and engravings into page *form, and stereotypers make plates of these* for the presses. Pressmen supervise the giant presses that produce thousands of copies of the newspaper. Circulation truck drivers speed the papers to newsboys at stands or home delivery depots. Added to this list of workers are those in such departments as business, advertising, and special features.

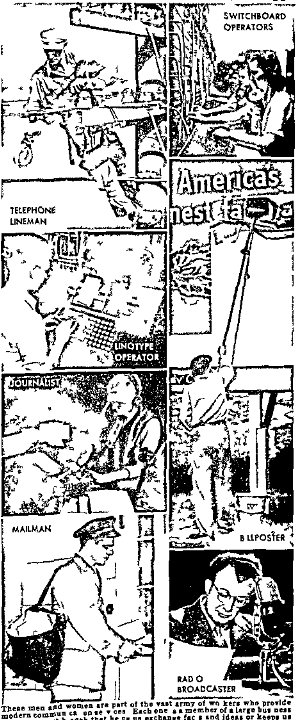
Every business or social organization requires its own special communication workers. Truck dispatchers, stenographers, traffic policemen, and club secretaries are only a few examples. No census has ever been taken of all people who provide communication, but they probably number several million.

How Communication and Communities Grew Together

The connection between communication and living together in modern communities can be shown by tracing their development. *For* hundreds of thousands of years men lived only in small groups. At first about the only way they could communicate was by talking face to face. Learning to write helped more people to live and work together, and communities expanded. People could exchange long written messages, and they could keep accurate records. Learned men could write down what they knew for others to study.

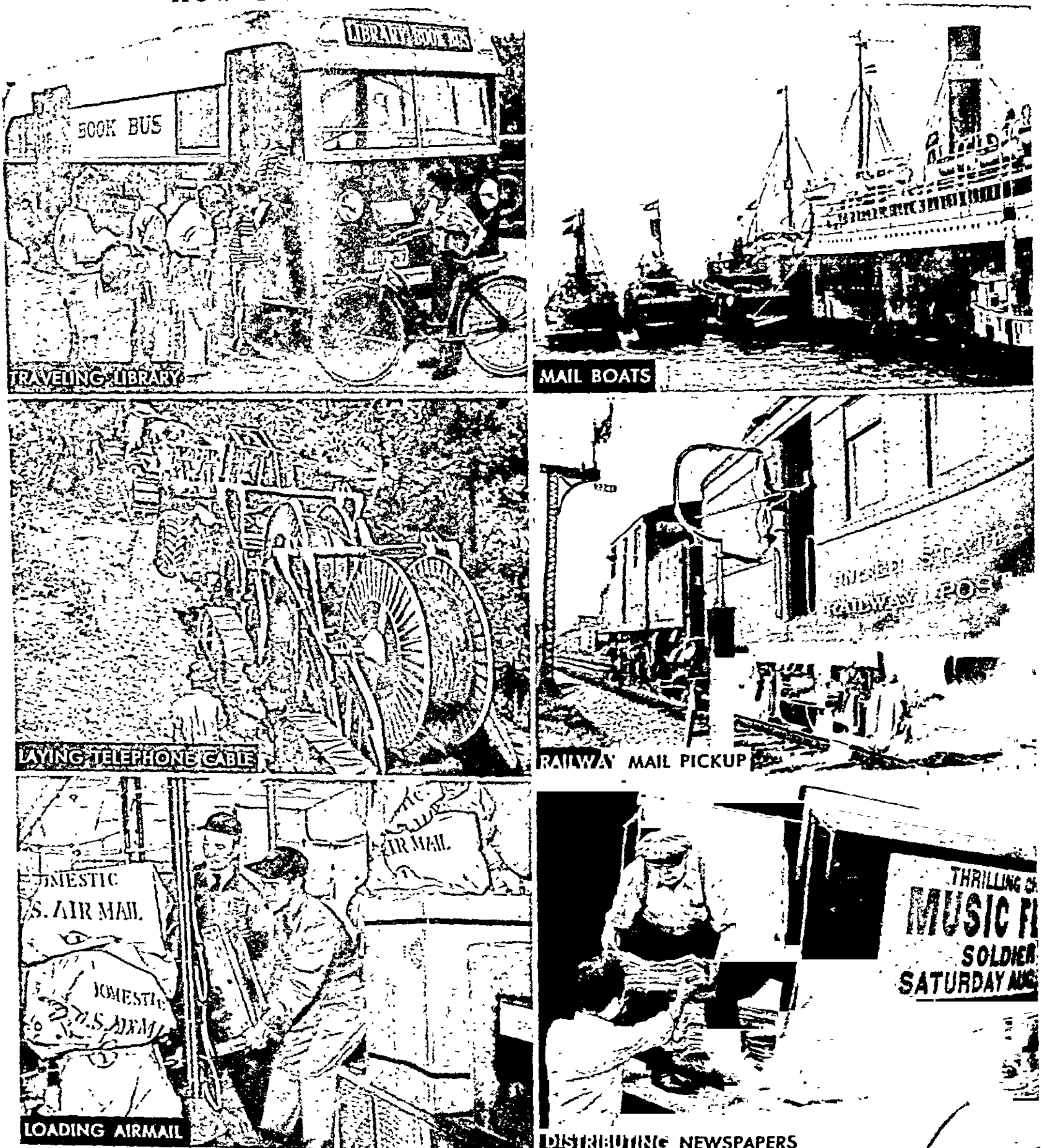
Printing enabled men to make many copies of books *and papers, but they* could not send or distribute them any faster than before. *Speed* of communication still depended on how fast a horse or a sailing ship could carry

COMMUNICATION WORKERS IN THE COMMUNITY



These men and women are part of the vast army of workers who provide modern communication services. Each one is a member of a large business or government branch that helps us exchange facts and ideas or keeps us informed of important news events.

HOW TRANSPORTATION HELPS COMMUNICATION



These pictures show how communication depends on transportation. Ships, airplanes, trains and motor vehicles carry written or printed messages from place to place. Motor vehicles, such as the tractors used in laying telephone cables, help build communication systems and keep them running. Communication service speeds up when men find better transportation methods.

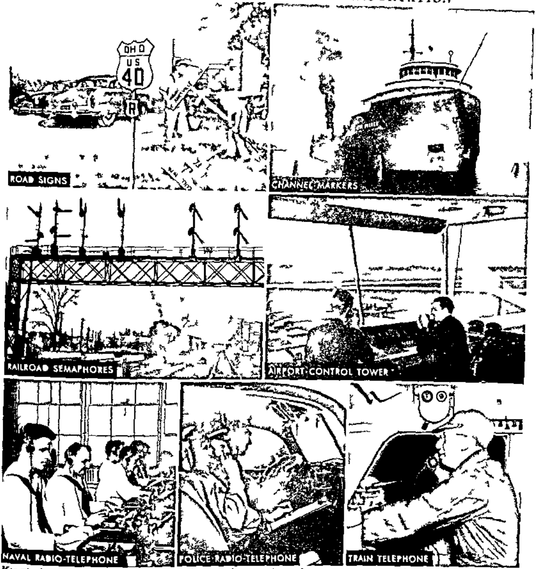
a message. When the first trains and steamships came into use, people could send messages somewhat faster. But the men who planned the movements of ships and trains needed a way to send messages *ahead* of these vehicles in order to control them along the route. Until the way to do this was found, growth of both communication and transportation lagged.

When inventors learned to harness electricity for sending messages, communication and transportation services leaped forward. For example, with the telegraph, railroad men could control trains from station to station. The telephone and radio helped other transportation methods grow. Today communication and transportation serve each other in many ways, as the pictures on these pages show.

How Communication Spreads Entertainment

Men have used communication in every age to help in working and in living together. But they have also used communication to help in simply enjoying life. Among age-old examples are singing, plays, and recitations of folk tales, poems, and accounts of heroic deeds. Today great industries are engaged in this

HOW COMMUNICATION HELPS TRANSPORTATION



Men who d e o gu de sh ps p anes a ns and mo o eh es need some fo m o commun a on o he p them on heir way The ommuni a on ma be oad signs banne ma ke s o semapho e s gna ha show he p op ou e o ake O may be a vo e message a ed by ad o o ephone ha e s he d v whe e o go o how o ge the e

form of communication. Among them are motion pictures, radio, television, and a considerable part of book and magazine publishing.

As a rule communication for entertainment does not seek to impart information or arrange for action of any kind. Rather it seeks to impart the entertainer's emotions and feelings of joy or sorrow, excitement and thrills, laughter or even terror. If the entertainer succeeds, thousands or millions of people can enjoy at second hand experiences and moods which they never could create for themselves. Millions can thrill to the voice of a great singer on the radio, in a sound movie, or on a phonograph, even though they cannot sing a note themselves.

A great author can provide entertainment for people all over the world, and even through many centuries. Fine paintings and sculpture can illustrate the maker's mood and give pleasure as long as they endure, and some measure of enjoyment can be conveyed more widely by printed reproductions. Communicating entertainment is one of mankind's greatest means for achieving happier lives.

How Communication Advanced through the Ages

TODAY a rich array of communication methods serves our needs. Some of them were developed gradually through the ages; others sprang directly from the work of ingenious inventors. Accounts of how the most important methods came into use are given in such articles as Alphabet, Photography, and Television. (*See also* the Reference-Outline at the end of this article and the entry **Communication** in the FACT-INDEX at the end of this volume.)

Individual methods, however, form only part of the story of communication. None of them would have been developed—or if developed, they would not have been used—unless men felt a need for them at the time. As civilization advanced, growing needs were met by new communication methods. In turn, once the new methods appeared they often helped speed up the course of progress. Thus communication grew as part of civilization from earliest times until the present.

How Early Man Met Communication Needs

PROBABLY from the very beginning men have lived in groups. These primitive men sought each other's company for protection against danger, for help in gathering food, and for companionship. Living together at once produced a need for *language*. We have a good idea of how language developed because scientists have studied this process among primitive societies that still exist in isolated places, particularly on Pacific islands.

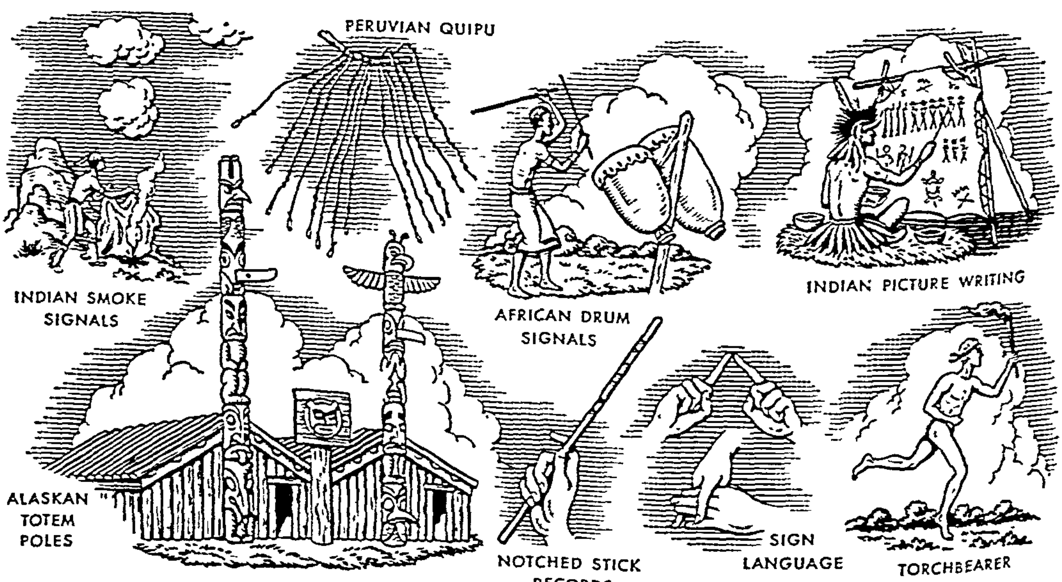
In the beginning their language probably consisted only of chattering noises and cries accompanied by gestures. At first they made a whole set of connected sounds to describe one idea, and an entirely different set of sounds to express another idea. Gradually they learned that if the thought "tree" appeared in each idea, the thought "tree" should be expressed by the same sound. Thus they began to develop individual *words* later than they did whole sentences.

Primitive men also thought about more than just the needs of daily living. They sometimes expressed these thoughts and feelings through dancing and through *art*. They painted figures of animals on the walls of their caves, often in color. These were largely for magical or religious purposes, perhaps to insure good hunting. But the extra effort to make the paintings artistic showed that these primitive men had a need to communicate through self-expression. (*See also* Language; Man.)

New Methods for Growing Needs

Through the centuries communities grew in size and number. People worked together as farmers, herders, and fishermen. They traded with each other for things they could not get by themselves. As new communication needs arose, men gradually worked out new methods to meet them. The swiftest *runners* were selected to carry word-of-mouth messages over long distances. With meanings arranged in advance, men sent *signal messages* by smoke puffs, fire beacons, or drumbeats (*see* Signaling). The American Indians worked out a sign language, useful for simple communication between tribes who spoke different languages. Seafaring peoples lit bonfires on shore for guiding ship-

PRIMITIVE MEN DEVELOPED SPECIAL COMMUNICATION METHODS



Primitive men worked out many communication methods to solve special problems. They sent messages over long distances by smoke signals or drums. A runner with a torch aroused people in an emergency. Men kept records on totem poles or notched sticks, or knotted strings, or by drawing little pictures. Men who spoke different languages talked to each other with hand signs

at night These were the first lighthouses Even in ancient times they grew into such mammoth structures as the Pharos at Alexandria, Egypt

Simple means of recording began early Families and clans arose in the community, and each had some mark of identification which members used as a kind of signature This was often a seal or design pressed into wet clay. At first most general ways of recording were merely aids to memory such as we now use when we tie a string around our finger The Peruvian Indians actually used a whole set of knotted strings called a *quipu* (*see* Incas) Notched sticks and scratches on stone, shells, and clay shards were also used for recording

Such records were also used to keep track of time The beginnings of a *calendar* in many places around the world showed that primitive people were able to *record the length of seasons and the movement of* heavenly bodies Undoubtedly they did this for centuries before the first calendars appeared (*see* Calendar)

The First Writings

To IDENTIFY their scratches and notches, men began making little pictures These sketches crude but easily recognized, were strung together to form the first written communications Out of different versions finally came standard pictures, called *pictographs* which everyone in the community could understand Pictograph writing was used by nearly all primitive peoples Curiously, the same pictures for certain words arose in widely separated places The Indians of southern Alaska used a pictograph of a man with widespread arms to mean "nothing" This same picture was drawn by the Mayas of Yucatan, in Central America, and in a similar form by the ancient Egyptians

From the pictographs came *ideographs* These were simplified pictures, easier to write Sometimes the ideographs combined two or more pictures into a single idea For example, the Chinese ideograph for "wife" combines the pictures for "woman" and "broom" When men began to use ideographs for sounds alone, the way was open for an alphabet of single letters How this came into being is told in the article on Alphabet Alphabets made signaling easier since all that had to be prearranged was a signal for each letter The Greeks worked out a good system of torch signaling shown in the frieze below They set their alphabet down in five rows, five letters in a row Then the number of torches in one rack indicated the row, and the number of torches in a second rack showed the *right letter within the row*

For their first writing materials men used whatever was at hand—flat stones, metal, wood, bark, or animal hides Stone and metal still serve today for carrying lasting inscriptions For less important writing two other materials came into use very early The Babylonians wrote on soft clay tablets, then hardened them by baking The Egyptians pressed the stalks of the *papyrus* plant into sheets for writing surfaces (*see* Papyrus Plant) They pasted the sheets end to end to form rolls or scrolls

The Greeks and Romans used papyrus, they also wrote on wax-coated wood tablets Some centuries before the birth of Christ, the Greeks began to use *parchment*, a smooth and pliable surface made from the skins of sheep and goats The Romans used both papy-

COMMUNICATION METHODS IN ANCIENT TIMES

In ancient times men devised new ways to meet communication needs They sent messages by carrier pigeon or by swift horse and chariot They wrote on soft clay tablets or on papyrus *They* built giant lighthouses, such as the Pharos at Alexandria, Egypt The Greeks worked out a torch telegraph system, described in the article Roman orators perfected the art of public speaking

rus and parchment in sheets rather than in rolls. Bound together, these sheets became the first *books*. The Chinese had been making *paper* since ancient times, but its manufacture was not known in Europe until after the 8th century. (*See also* Paper; Writing.)

Literature and Libraries

Men began early to practise and to admire skillful use of words in speech and writing. The ancient Greeks had poets and playwrights whose works live today. They told exciting stories of gods and heroes; tragic tales of men caught in the web of fate; and humorous fables of animals with the power of speech and reason. The Romans had great orators who spoke stirringly of statecraft and war. Greek and Roman philosophers and historians left important records of the life and thought of their times. The Reference-Outline in the Language and Literature article lists topics for discussions of how literature developed in many places around the world.

Almost from the beginning of the art of writing, men collected written records. How these collections grew into the great libraries of the ancient and modern world is told in the article on Libraries.

Speed of Communication Becomes Vital

By the time the Romans had developed their parchment books, they also excelled in many other ways of living. One of their foremost achievements was building good roads across Italy and establishing protected sea lanes to their far-flung colonies.

Riding on horseback or in horse-drawn chariots, messengers raced from city to city carrying letters. Sail-and-oar galleys pushed across sea lanes bringing messages to foreign possessions. Even these methods were sometimes too slow. Julius Caesar sent messages from his military headquarters back to Rome by *carrier pigeon*. When the Roman Empire fell and its roads were allowed to crumble, swift overland communication across Europe virtually ceased for hundreds of years.

Printing Quickens the Course of History

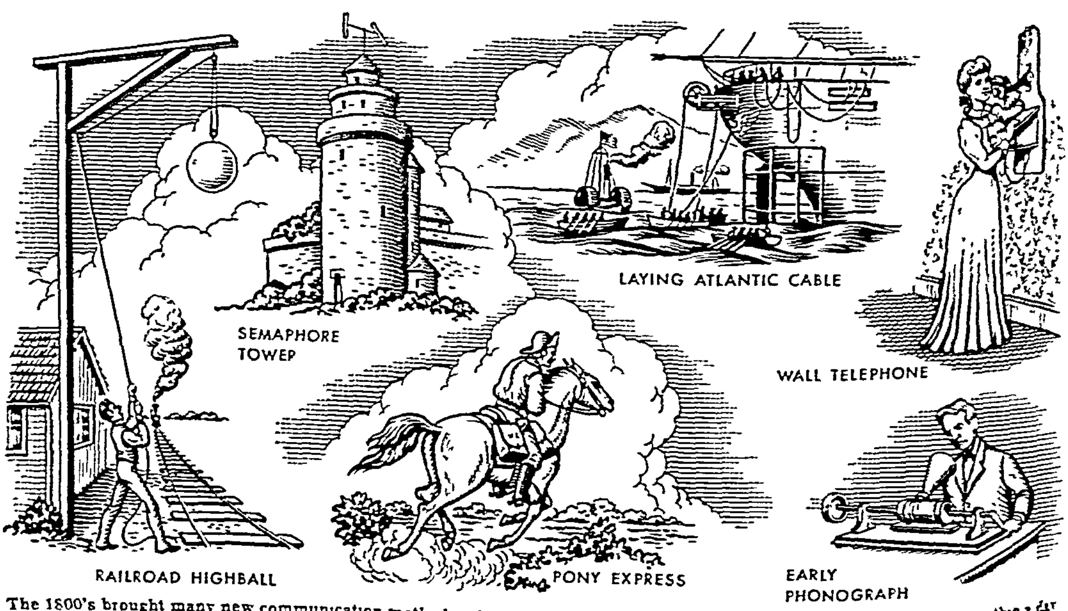
THE REBIRTH of Greek and Roman learning, now called the Renaissance, began in the 1300's. After centuries of almost complete oblivion the words of ancient philosophers and historians brought renewed understandings of man and his life on earth. From this stimulation sprang expressions of new ideas.

But old and new thoughts had to remain confined in hand-copied manuscripts until Gutenberg in the 1400's made *printing* from movable type practical. Now printers could turn out thousands of copies swiftly and cheaply. The technique of *engraving* enabled pictures to accompany the printed words. Men everywhere could read what others had written and history blazed forth on a new era of progress (*see* Renaissance).

Printed books on geography and travel inspired Columbus to plan a voyage across the unknown Atlantic. Books helped lead other Renaissance men to great achievements in science and government. The printed Bible made possible the Protestant Reformation. (*See also* Books; Gutenberg; Printing.)

The Renaissance brought forth other aids to communication—usable *maps* of the known world and accurate *drawings* with correct perspective. It was also a time of magnificent art production. Men were

EXAMPLES OF 19TH-CENTURY PROGRESS



The 1800's brought many new communication methods. A series of towers could relay signal messages across France within a day. The Pony Express carried letters across the western United States The Atlantic cable linked America with Europe Early station agents hoisted a ball to give an "all-clear," or "highball," signal to trains. The telephone and phonograph came late in the century

eager to express themselves and they communicated thoughts and feelings in great paintings sculpture and architecture

The closing years of the Renaissance saw the development of *postal systems* in many European countries Before then even in Persia about 500 B C riders carried messages along a regular route but this use was reserved mainly for kings and governments The American Colonies had their first post office in 1639 (*See also* Post Office Stamp and Stamp Collecting)

Effects of the Industrial Revolution

THE GAINS of the Renaissance were won with the aid of the strength of men and animals Machines were still largely unknown The next great advance in communication came when men learned to harness the power of steam and to invent machines for using it

The new era began in the 1700s By 1770 it had *upset so many ways of living and working that historians call it the Industrial Revolution* Steam power helped bring about this revolution As an aid to communication steam ran the printing presses It also drove the new trains and steamships that carried messages more swiftly and dependably than the older coaches and sailing vessels (*see* Transportation)

Older methods still had their uses In Napoleon's time engineers built a series of relay towers across *France Men stationed in the towers* worked semaphore arms and relayed the messages from tower to tower Even well into the 1800s relay teams of horseback riders called the Pony Express carried letters across the American wilderness

As we have seen good transportation systems depend upon communication for their control The first such control was provided by the *telegraph* It was adopted by the railroads soon after its invention in the 1830s (*see* Telegraph) The following decades saw the laying of *telegraphic cables* along ocean bottoms (*see* Cables) With it ships in foreign ports could receive orders from home offices

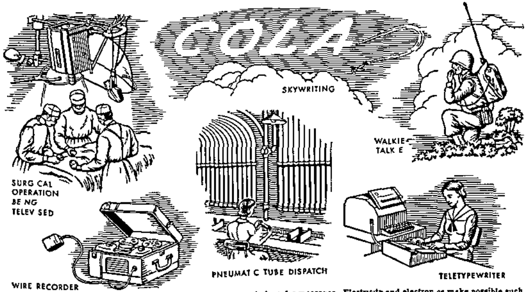
Inventors during the Industrial Revolution produced another invaluable aid to communication—*photography The camera could instantly record what* the photographer saw and the picture could often serve better than words for reporting the scene to others (*see* Photography) Photography later led to *photoengraving* This enabled printers to reproduce all sorts of pictures in their books magazines and newspapers (*see* Photoengraving and Photolithography)

Electricity—Servant of Modern Communication

THE TELEGRAPH was the first of a long series of inventions that use electricity for communication In the 1800s inventors learned to put electricity to work The results brought even swifter progress than had the beginnings of steam power about a century before These pioneers in electrical research are discussed in the article Electricity subhead The Men Who Discovered Electricity's Secrets and in separate biographies

Electricity now makes possible such communication methods as the telephone radio television and the phonograph and other recording machines It provides power for printing presses typesetting machines, and other devices to turn out printed matter

MEN STILL SEEK NEW WAYS TO COMMUNICATE



These examples suggest man's continuing search for new ways to transfer messages Electricity and electronics make possible such devices as the walkie-talkie (two way portable radio) teletypewriter wire recorder and television with its many special uses Pneumatic tubes serve many communication needs and aviation offers the spectacular method of skywriting

Transportation methods that carry written and printed messages depend upon electricity for direct power or for aid in engine operation. Electricity also provides all kinds of communication controls for transportation—for example, railroad signals, street traffic lights, and airplane beacons.

The telegraph continues in use for railway communication; and the telephone and radio offer similar service to other forms of transportation. Airplanes especially depend on radio for guidance in flight and in landing (*see* Airplane; Aviation). Linked with the ability of radar to "see" objects for miles around, radio aids to air and sea navigation now make such transportation safe and dependable.

Future Progress of Communication

The limit of communication development has by no means been reached; and some day people may regard present methods as old-fashioned. Already *color television* promises new reality to television audiences (*see* Television). For keeping permanent records, *microfilm* is rapidly supplanting bulky libraries and files (*see* Microfilm). *Wire and tape recordings* now carry sounds that once had to be put on large disc records (*see* Phonograph).

Beyond these examples of new methods already in use, scientists are experimenting in other fields. *Phototypesetting* may some day replace present mechanical methods (*see* Linotype). The home television receiver may be adapted to turn out *facsimile* newspapers on rolls of sensitized paper. The use of ***infrared radiation*** ("black light") holds great promise for a number of communication developments (*see* Infrared Radiation).

Scientists are also experimenting with modulation of visible light waves for sending messages, using techniques somewhat similar to present methods of modulating radio waves. The whole electromagnetic spectrum is being studied for similar communication uses (*see* Radiation). For swifter and cheaper printing, electronic transfer of ink from printing plates to paper may supplant present direct-contact methods. (*See also* Electrons and Electronics.)

POSTED BULLETINS BROUGHT LATE NEWS

Before the days of radio, newspapers posted bulletins in front of their offices. These offered hour-by-hour developments of important news events. This bulletin tells of the sinking of the steamer *Titanic* in 1912.

Modern Problems in Communication

THE FIRST Amendment to the Constitution of the United States guarantees freedom of speech and of the press. This freedom has been extended to all forms of communication; but certain practical limitations have also been imposed. For example, laws against slander and libel forbid circulation of falsehoods. Postal regulations prohibit using the mails to defraud. Food and drug laws prevent manufacturers from offering misleading or deceptive information on labels or in advertising.

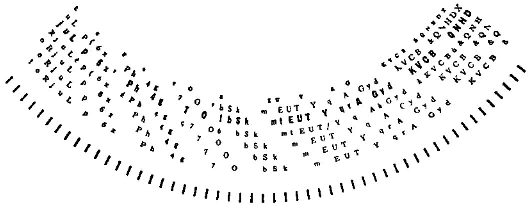
In these ways and in many others, freedom of communication in the United States is kept within bounds. In other democracies, similar freedom prevails. But in totalitarian countries, all forms of communication are usually under state control. Dictators thus try to prevent any communication activity which may threaten their rule.

Government Regulation of Communication

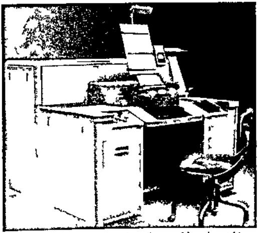
The Post Office Department is the only general communication carrier in the United States under public ownership. Telephone and telegraph systems and radio and television networks are owned by private corporations. But since these systems serve the public, their operations are closely supervised by the Federal Communications Commission, established in 1934. This is an independent government agency that regulates interstate and foreign commerce by wire (telephone and telegraph) and radio and television. Its control extends to private corporations and to state and local governments. One of its important functions is to assign radio and television frequencies to all transmitting stations, except to stations operated by the Federal government itself. Frequencies for Federal government use are assigned by the president.

The United States is a member of the Universal Postal Union which unifies postal rates and services in nearly every nation around the globe (*see* Post Office). As a member of the United Nations, the United States also subscribes to the rulings of the International Telecommunication Union. This United

SETTING TYPE BY PHOTOGRAPHY



The characters above form part of a disk (called a matrix) which carries several fonts of type. For typesetting, the disk whirls at high speed. Whenever a key is struck on the machine at the right, a light flashes at the right instant to create an image of the desired character. Lenses and a moving mirror then record the image on a photographic surface at the correct place to form a line of type, character by character.



An operator uses the keyboard on this machine almost like a typewriter to set type from the matrix shown above. The type will be arranged exactly as it is to be printed. When the operator has finished, the machine furnishes a photographic surface from which an engraving of the type can be made.

Nations agency sets up regulations for international wire and radio service.

Censorship and Self Regulation

In wartime the government assumes the power of censorship over all communication that might injure or otherwise affect the war effort. Military censors outside the United States review all news dispatches written by war correspondents and all letters written by members of the armed forces. Other censors watch international mail and cables and radiotelephone and short wave communications.

State and local governments have certain censorship powers, especially over motion pictures and printed matter. Motion picture review boards are authorized to ban all or part of a movie if they judge it unsuitable. Local police enforce ordinances that prohibit the sale of books and magazines considered objectionable. These agencies seldom need to act because motion picture, radio and television producers and book, magazine and newspaper publishers have themselves agreed upon standards and codes of morality for their products. (*See also* Motion Pictures; Radio section, Social Problems Created by Radio.)

These standards can grow and change. Today thinking people make their judgments of a book, movie or play in the light of the author's purpose. If the author is sincere and serious in his depiction, people are inclined to accept what they might object to in a work of less serious nature. Another basis for judgment is whether the work is intended for mature audiences. If it is directed at young and impressionable minds it must be held to stricter standards.

Propaganda—What Is It?

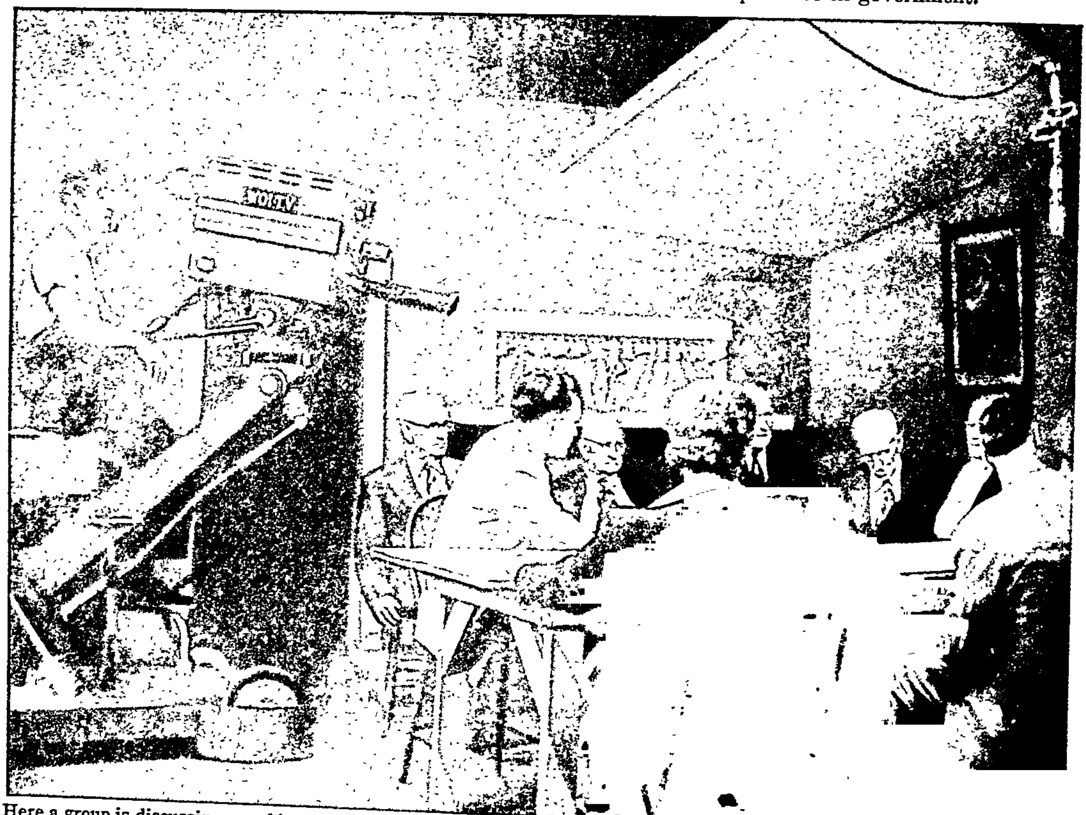
The development of modern communication has emphasized the problem of propaganda. The press, the radio, the public platform and the mails are used by governments and politicians, by business and labor interests—by promoters of all sorts of causes—to influence the feelings, opinions and actions of the public.

Propaganda enters the school, the church, the home, the theater, and it influences all of us to some extent. It may win success for a health campaign, or it may bring about a revolution. It is used to promote both war and peace, to stir up hatred and to gain sympathy for human suffering. In the form of advertising it may help to persuade us to accept the new products of science or it may promote the sale of quack remedies.

The word "propaganda" literally means the "propagation of a doctrine." In a popular use the word suggests the kind of argument or appeal which is intended to lead toward a goal more or less concealed or disguised from the reader or listener. To argue that a certain law will benefit the majority when it is actually intended to give advantages to a minority group is propaganda in this popular sense. However the word may be defined, the fact remains that propaganda

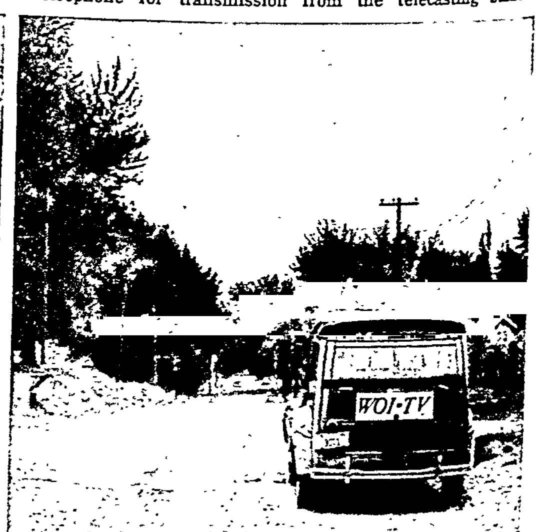
TOWN MEETINGS BY TELEVISION

Television developed social and political usefulness when station WOI of the Iowa State College at Ames, Iowa, started showing town meetings for small communities. The service created much greater citizen interest in solving problems. Schools often have children watch and listen as an experience in government.



Here a group is discussing a problem of importance to the community in town meeting. Meanwhile, an operator from station WOI is picking up the scene and the talk with his camera and microphone for transmission from the telecasting station.

These townspeople have dropped into a store to watch the meeting and to hear the arguments, using the store's television set. Thus the whole town can know what is decided and why.



The broadcast done, station WOI's portable equipment moves on to do a telecast for some other community. Station specialists, of course, precede it to make the necessary arrangements.

is a strong force whether it is employed either for good or for evil

Governments and Propaganda

Modern governments have departments which issue official propaganda. They also watch foreign propaganda within their borders. The first and second World Wars proved the effectiveness of propaganda in wartime and the belligerents planned their campaigns of press and radio as carefully as they did their military strategy.

In totalitarian countries propaganda is a state monopoly. No criticism is permitted and no opponent can raise his voice. However totalitarians freely invade democratic countries with their own propaganda and protest loudly when they are not allowed to speak. Democratic governments must counteract these skillfully presented antidemocratic doctrines.

The United States government as a check on organized foreign propaganda in 1938 enacted a law requiring every person acting as a publicity agent for a foreign government political party or other foreign organization to register with the Department of State. To check on the propaganda which is brought to bear upon members of Congress in order to influence legislation the Regulation of Lobbying Act was passed in 1946. This forced lobbyists to register and to account to the government for the sources of their income and the spending of their funds.

As a positive answer to antidemocratic propaganda the United States began broadcasting Voice of America programs after the second World War. These programs were sponsored by the State Department. The privately sponsored Radio Free Europe offered the same type of programs.

Recognizing Propaganda

A great help in forming intelligent judgments upon printed material is ability to recognize the devices frequently used by propagandists to influence opinion. They may be grouped as follows.

Name calling arouses our hate and fear by giving names to individuals groups ideas or policies which the propagandist wishes us to reject or condemn. In the democratic United States dictator and fascist are name calling words. Politicians often apply such words to leaders of the opposition.

Glittering generalities is the reverse of name calling. It is the uncritical use of virtue words — such as freedom justice honor—to win us to a cause. Politicians often appeal to patriotism to win support even though patriotism may not be involved.

By the device called *transfer* the propagandist carries over to his cause the authority sanction and prestige of something we respect. For example he may get a church or a university to sanction his program. Symbols—the flag the cross, Uncle Sam John Bull—are constantly used for this purpose.

The *testimonial device* consists in having some respected person say that an idea program product or person is good.

The *plain folks* device is a familiar trick by which the advocate of a cause identifies it and himself with ordinary or plain people. Almost any American political speech contains examples.

Card stacking consists in presenting a barrage of evidence from only one viewpoint. It selects facts or falsehoods logical or illogical statements which make the best or the worst case for a cause.

TRANSLATING AT THE UNITED NATIONS

At the United Nations General Assembly delegates from many nations meet even though they do not understand each other's languages. Interpreters send translations of the proceedings through telephone headsets to delegates who require them.

Propaganda and Semantics

Understanding propaganda and its effect on judgment and thought is part of a larger study of a subject called *semantics* or the science of meanings. The name comes from the Greek word *semantikos*—significant meaning. Students of semantics begin with the dictionary definitions of words but go on to analyze changes in the way people use words especially when the new meanings have added power to sway feelings or to influence thinking. They learn to tell the difference between a *report*—a factual statement—and a *judgment*—an opinion or conclusion. They study *loaded* words which arouse emotions. They learn

KEY TO PICTURES ON C 422 AND C 422a

1	Notebook	19	Dictaphone
2	Pen	20	Mailbox
3	Chalk	21	Advertisement
4	Crayon	22	Newspaper
5	Brushes	23	Door knocker
6	Paintbox	24	Fire-alarm box
7	Paper	25	Map
8	Pencil	26	Calendar
9	Encyclopedia	27	Camera
10	Record player	28	Bell
11	House number	29	Blackboard
12	Clock	30	File records
13	Telephone	31	Television receiver
14	Picture	32	Sign
15	Pen and pencil set	33	Radio
16	Interoffice speaker	34	Typewriter
17	Letter	35	Book
18	Magazine	36	Movie projector

to detect *slanting* especially in news reports. Slanting is a process similar to propaganda card stacking. Facts, true in themselves, are selected to support one point of view; facts which might weaken that point of view are omitted. The study of semantics thus leads to an understanding of the power words have to affect or even permanently alter relationships between people and nations. As a scientific study, semantics was first proposed in the 1920's by Alfred Korzybski, a Polish-American teacher and writer.

REFERENCE-OUTLINE FOR STUDY OF COMMUNICATION

WHAT COMMUNICATION MEANS IN OUR LIVES

I. How communication helps us in our daily living C-421-422*b*, U-327, pictures C-422, 422*a*, 422*b*
- A. Provides news and entertainment C-422*b*, 422*c*, 422*d*, 423: newspapers N-186, pictures N-191; magazines M-29; radio R-44; motion pictures M-407; television T-50
- B. Regulates traffic C-321, S-10-11, P-354, color pictures P-352, 353, pictures C-423
- C. Gets help to save life and property C-422*b*: fire alarms F-83, color pictures F-82: calling the police P-355*b*, picture P-355*a*; aids Red Cross in disasters R-87*a*
- D. Brings the world to farms and isolated communities T-39, F-23, R-47

II. Helps in the world's work and in shaping world affairs C-422*b-d*, pictures C-421, 424*d*, 424*e*
- A. Gives world-wide exchange of news C-424*e*, N-190-2, R-44, T-45, T-50, pictures N-191
- B. Helps in shaping public opinion and decisions C-424*e*: influences political thinking P-357, pictures P-358, 359, R-214, T-199
- C. Helps in gaining and preserving knowledge C-422*c*, 424*a*, 424*b*, C-325: libraries L-180
- D. Speeds planning and agreements T-39, pictures C-422*a*, R-212, 213, W-255, 298, U-240*a*, 240*b*

III. How communication and transportation help each other, pictures C-422*d*, 423. See also the Reference-Outline for Transportation

IV. Communication in the United States U-324, 327. See also the Fact Summary in each state article

V. Communication in other lands: see in Fact-Index names of continents and countries with *subhead* communication

HOW COMMUNICATION IMPROVED THROUGH THE AGES

I. Communication begins with speech, pictures, and signs C-424
- A. Origin and growth of language C-424, C-325, L-98*b*, diagram L-98*a*
- B. Use of signs, signals, and pictures: early signaling methods S-177, T-36; American Indians C-424, I-106*e*, picture C-326; cave men drawings M-64, C-424*a*, color picture M-67, pictures D-137, M-63, 64; calendars and other early records C-424*a*, C-22 (Incas I-50, Aztecs, picture A-543)

II. Writing and the alphabet bring improvement C-424*a*, W-310-310*a*, A-176-9
- A. Sign and symbol (ideographic) writing
  1. Cuneiform and hieroglyphics C-529, H-355, pictures W-310*a*. See also the Reference-Outline for Ancient History
  2. Aztec and Mayan signs and numbers A-543, M-144, pictures W-310*a*
  3. Early writing materials B-231-2, C-424*a-b*: paper P-68*a*: papyrus P-68*a*, P-72, E-285, 286; pen P-114; ink I-150
- B. Early ways of recording numbers N-312-312*a*: quipus of the Incas I-50
- C. The alphabet simplifies writing A-176-9: spread by Phoenician traders P-205
- D. Writing preserves and spreads knowledge C-424*a-b*, C-326
  1. Copying books by hand B-231-8
  2. Collected knowledge made available in early libraries: ancient L-180-1; Greek and Alexandrian L-181, A-150; Roman L-181; in the Middle Ages L-181-2
- E. Writing gives rise to literature L-98*b*, C-424*b*. See also the Reference-Outline for Language and Literature

III. Early ways of gaining speed C-424*b*, pictures C-424*a*: pigeons P-254; roads R-160: postal systems P-385; signaling T-36, S-177, B-118

IV. Spreading knowledge and influencing thought by spoken word and dramatic action C-424*b*. See also the Reference-Outline for Language and Literature, section National Literatures

V. Modern communication begins with printing C-424*b*, P-414*c*, T-229-30, B-238-9: Gutenberg G-235; influence on education E-240; libraries L-182

VI. Industrial Revolution brings railroad and steamship carriers C-424*c*. See also the Reference-Outline for Industrial Revolution

VII. Rise of postal systems C-424*c*, P-386: in American Colonies P-386-7, pictures T-170*f*, A-214; postage stamps S-366-7; air mail P-385

VIII. Improvements in picture communication C-424*c*: engraving and etching E-385-8: lithography L-276: photoengraving and photolithography P-210*a*-211: photography P-225-7 (microfilming M-230-1); motion pictures M-431-3

IX. Modern electrical methods conquer distance C-424*c*
- A. Telegraphy T-36-9: Morse, the inventor M-395; underwater cables C-5-8; telephotography I-203, T-45
- B. Telephones T-39-45: Bell B-121: Pupin P-438
- C. Sound recorders and reproducers: phonograph P-206-8, picture E-236: dictating machine D-87-8; dictograph D-89; wire recorder P-208; motion-picture sound track M-421-2, picture M-411
- D. Radio R-33-51
  1. Inventors: Marconi M-93; Hertz R-29, R-42-3; De Forest D-46
  2. How radio works R-33-44, 45
  3. News and entertainment broadcasts R-44-49
- E. Television T-50-5, R-51

COMMUNICATION IN THE MODERN WORLD

I. Principal methods used today C-421-3
- A. For widespread communication, pictures N-191
  1. Modern printing and engraving P-413-414*c*: the typewriter T-231
  2. Newspapers and magazines N-186-92, M-29-31

3 Books and libraries B 231 9 L-180 200 Braille for the blind B 206 7
4 Radio broadcasting R-44 9 television T-50-3
5 Advertising A 23 7 electric signs E-314

B For person to person communication letters L-171-4 conversation C-458-61 telegraph T 36 telephone T-39 radiotelephone T-44
C Modern record keeping see in Fact-Index Communication *subhead* records

II Communication for general information and agreement upon action
A In production and business activity weather reporting W 82 stock exchange trading S-399-400 boards of trade B 213-14
B For political action national conventions pictures P-358 359 town meetings T 150 pictures U 263 C-424*f* for international agreements (Cairo and Tehran Conferences pictures N 191 R 212 W 298 United Nations pictures U 240*a* 240*b* W 299)

III Communicating feeling and understanding with the arts A-400*a-p*
A Language and Literature see the Reference-Outline for Language and Literature
B Visual arts see the Reference-Outlines for Architecture Painting and Sculpture
C Musical, rhythmic and combination arts M-458 69 ballet B 28-28*d* dancing D 14-14 *n* (folk dancing F 192*a d*) drama D 120-35 opera O-388-98 orchestra O-402 6 See also the *Reference-Outline for Music*

IV Modern problems of regulation and control C-424*d*
A Expense and convenience of service may lead to granting and regulating monopolies P-430 M-359
B Government regulation of communication C-424*d-e* Federal Communications Commission R-205 R-42 49-50 Post Office Department P-388 public utilities P-430-1 radio R-42 49 50 telegraph T-39 television T-54*a* *d* foreign governments C-424*e* R-48-9
C Censorship C-424*e* motion pictures M-431 press C-424*e* radio R-49-50
D Propaganda C-424*e g* newspapers N-189 radio R-48-9 50-1 advertising A 26 Voice of America R-51, R-271 picture R-46

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(*See also* bibliography for Transportation)

COMMUNISM To most people of today the word communism means the doctrines internal life and external activities of Soviet Russia together with the activities of their collaborators in other countries This is a great change from the older meaning of the word—a change which the Soviet Communists themselves acknowledge

Originally the word meant 'owning or holding in common American Indians did this when they held a hunting ground for the whole tribe This practice has been widespread among primitive peoples since the early days of mankind It has also appeared regularly among more advanced peoples

Early Christian teaching condemned wealth exalted poverty and preached renunciation of the goods of this world Possessions were for the good of *all* Throughout the Middle Ages monastic communities practiced communism to a greater or lesser degree Many sectarian religious communities largely of German and Russian origin have practiced and still practice communist living in their agricultural settlements Communities where goods would be held in common were advocated and founded by Robert Owen of England Charles François Fourier of France and others (*see* Socialism)

The Famous Communist Manifesto of 1848

Up to this time communist experiments had been on a voluntary basis *A new note was struck when two* young Socialists Karl Marx and Friedrich Engels issued their Communist Manifesto' in 1848 They called the Manifesto ' communist ' not socialist in order to *dissociate themselves* from the teachings of Owen and Fourier Marx and Engels also called for a revolution, to be led by the industrial working class (which they called the *proletariat*) to establish their version of communism

The Communist Manifesto proclaimed the philosophy called *economic determinism* This teaches that

history is shaped (determined) by methods of production and exchange. Marx saw social development as a process of evolution from lower to higher forms of society. Feudalism, for instance, was a step forward from the slave state of antiquity. Capitalism was an advance from feudalism.

But, the Manifesto maintained, capitalism must in time give way to the higher form of socialism, or Communism. Capitalism, in Marx's opinion, was marked by inevitable class struggle between the owning class (the *bourgeosie*) and the hired working class (the *proletariat*). He held that the owning class exploits the working class by appropriating the difference between the value of what the workers produce and what they receive as wages.

The Manifesto called for the proletariat to become the ruling class. In so doing, it used a phrase which has since become famous—"the dictatorship of the proletariat." The Manifesto ended with an open call to violent upheaval:

> "The Communists . . . openly declare that their ends can be attained only by the forcible overthrow of all existing social conditions . . . let the ruling classes tremble at a Communist revolution."

The Communist Break from Socialism

Marx and his early followers helped organize in 1864 the International Workingmen's Association ("First International"). It could not agree on long-range policy, and it broke up ten years later. In 1889, six years after the death of Marx, his followers took part in forming the Second or Socialist International. This organization continued in existence until the outbreak of the first World War in 1914.

The trend in European socialist parties in later years was, in the main, away from violence and toward moderation. The condition of the workers as regards food and clothing, housing, and opportunities for education and recreation was improving, not deteriorating, as Marx had predicted. Consequently, socialists were inclined to work for more advantageous social legislation and to put off the idea of violent revolution to an indefinite future.

One group, however, in the Socialist Second International (the world organization of socialist parties, created in 1889) adhered to Marx's more extreme philosophy. Outstanding in this group was the Russian revolutionary, Nikolai Lenin. He emphasized the need for a strictly disciplined revolutionary party.

Lenin's uncompromising attitude helped to split the Russian Social Democratic party into two groups. Lenin's followers were known as Bolsheviks (from the Russian word *bolshinstvo*, meaning majority). His opponents were Mensheviks (from the Russian word *menshinstvo*, meaning minority). This was because Lenin's supporters were in a slight majority at a party congress where the split took place.

Lenin's Version of Communism

The first World War and the fall of the czar in March 1917 gave Lenin his chance. Returning to Russia from his exile in Switzerland, Lenin led a second revolution to victory in November 1917. Out of this second revolution came the Soviet government. This came to be dominated entirely by the Bolshevik party, which changed its name to Communist in 1918.

Lenin believed that there must be a rigid dictatorship of the proletariat, as a transitional stage between the old capitalist order (which was to be destroyed) and the new Communist order. This was the theoretical justification for the absolute dictatorship exercised by the Communist party. Lenin also believed that Communism could not exist indefinitely in Russia, in a state of peace with the "capitalist" world. He wrote:

> "It is inconceivable that the Soviet Republic should continue to exist for a long period side by side with imperialist states. Ultimately one or the other must conquer. Meanwhile a number of terrible clashes between the Soviet Republic and the bourgeois states are inevitable."

Lenin therefore attached great importance to creating a strong international organization of Communist parties. A Third Communist International (often called the Comintern) was formed in Moscow in March 1919. It was supposed to function as a kind of general staff of the world revolution, and permanent headquarters were set up in Moscow. A second and larger congress was held in Moscow July-August 1920. Here a detailed program of action was worked out and twenty-one conditions of admission to the newly formed Communist parties were laid down. These conditions were designed to exclude all moderate socialists from membership and to insure strict discipline in Communist parties. The twelfth condition calls for "iron discipline, with a party central committee which will be a powerful, authoritative organ with wide powers"; the thirteenth demands "systematic purges to clear the party of petty-bourgeois elements." Communists were required to follow, instantly and without question, every shift in Communist policy; that is, they must adhere to "the party line."

This organization was built up avowedly for the promotion of violent revolution. This is evident from the following excerpts from the twenty-one conditions for admission to the party:

> "3. The class struggle in almost every country of Europe is entering the phase of civil war. Under such conditions the Communists can have no confidence in bourgeois laws. They should create everywhere a parallel illegal apparatus which at the decisive moment should be of assistance to the party to do its duty toward the revolution. In every country where, in consequence of martial law or other exceptional laws, the Communists are unable to carry on their work legally, a combination of legal and illegal work is absolutely necessary.
>
> "4. Persistent and systematic propaganda must be carried on in the army, where Communist groups should be formed in every military organization.
>
> "6. Every party desirous of affiliating to the Third International should renounce not only avowed social patriotism, but also the falsehood and hypocrisy of social pacifism. It should systematically demonstrate to the workers that without a revolutionary overthrow of capitalism no international arbitration, no talk of disarmament, no democratic reorganization of the League of Nations will be capable of saving mankind from new imperialist wars."

The Comintern was utilized more and more to serve the interests of Soviet foreign policy. When the Soviet government, alarmed by Hitler's rise to power,

sought allies in the West and joined the League of Nations in 1934 a new strategy the so-called Popular Front, was prescribed for Communist parties in foreign countries Instead of attacking Social Democrats, Communists were instructed to work in political coöperation not only with socialists, but also with liberal and radical groups

In 1943 *in the second World War, the Comintern dissolved itself* This was interpreted as a gesture by Stalin toward closer cooperation with the United States and Great Britain But all Communist parties *remained devoted to the interests of Soviet Russia*

Communism Expands after the War

Russia's victories in the war and its diplomatic triumphs greatly spread the sway of Communism Communist governments were imposed on every nation of *eastern* Europe except Greece (*see* Europe) Russia dominated them behind an "iron curtain of censorship

When a "cold war" arose between Russia and the democracies in 1947 Communists set up a new international organization This was the Communist Information Bureau (Cominform) It was composed of Communist representatives of France, Italy and eastern Europe One of its chief purposes was to direct propaganda against the United States It also aimed to cripple the European Recovery Plan by inciting riots and strikes especially in France and Italy

Communism increased in Asia Chinese Communists who had fought the Nationalist government almost continuously since 1927, won control of China in *1949* By 1950 large areas of French Indo-China had fallen under the domination of native Communists

In 1950 the state-controlled press of Soviet Russia indicated that the world's Communist parties had between 25 and 26 million members The largest was the Russian party, with about 7 million members

The United States has been a target of Communist activity ever since the Comintern was founded The American Communist party has never had more than 100 000 members and usually far fewer It has never made a notable showing in elections But Stalin himself told American delegates to the Comintern "I consider the Communist party of the United States one of the parties to which history has given decisive tasks from the viewpoint of the world revolutionary movement . . . You must forge real *revolutionary* cadres and leaders of the proletariat who will be capable of leading the millions of American workers toward the revolutionary class wars "

Beginning in 1949 the United States investigated 'undercover" activities of American Communists and convicted 11 party leaders In 1953 President Eisenhower tightened security rules for federal employees

Definitions of Modern (Soviet) Communism

In defining Communism it is important to note that the *Russian Soviet system* bears no resemblance to the experiments in communal living and sharing of possessions undertaken by religious and philosophical groups Soviet Communism might be defined as a *one-party dictatorship* combined with state ownership of factories mines, railways banks, and farms (*see* Russia) International Communism has as its *ult mate goal* the establishment in other countries of conditions similar to those existing in Russia (*See also* Asia, Eisenhower, Europe, World History)

Terms Associated with Communism

Collectivism is a term widely used in two senses (1) as a designation for the programs of nonrevolutionary social ists and (2) as a broad expression, opposed to ' individualism to cover all doctrines and trends leading toward greater social control over human affairs

Anarchism teaches that justice and order can spring only from the free association of individuals without fixed laws or government supervision Thus anarchists oppose both socialism and capitalism The founder of the modern anarchist movement was Pierre Joseph Proudhon *(1809–65)* who proposed through education to prepare men to live without government Another ' philosophical anarchist was Tolstoy (*see* Tolstoy) The founder of violent anarchism (nihilism) was Michael Bakunin (1814–76)

Syndicalism is partly socialistic, partly anarchistic It proposes to bring revolution through a general strike by all trade unions Each industry is to be seized and operated by its workers The state is to be merely a federation of worker-owned industries Syndicalism has appeared chiefly in France and Spain In 1952 Argentina s Chaco province adopted syndicalism In the United States the International Workers of the World (I W W) active from 1905 to 1924 was syndicalist

Guild socialism, popular in England from 1906 to 1925, was a nonrevolutionary form of syndicalism

COMPASS, MAGNETIC Since earliest times men have found directions from objects in the sky. They have used the sun, the North Star, and the moon But these objects are not the best direction givers They change their places in the sky from hour to hour Often they are hidden by clouds or storms

But nature has given us a direction finder that works at all times and in all places Put a piece of magnetized iron on a splinter of wood and float it in a bowl of water The wood will swing around until the magnetized iron is pointing north and south

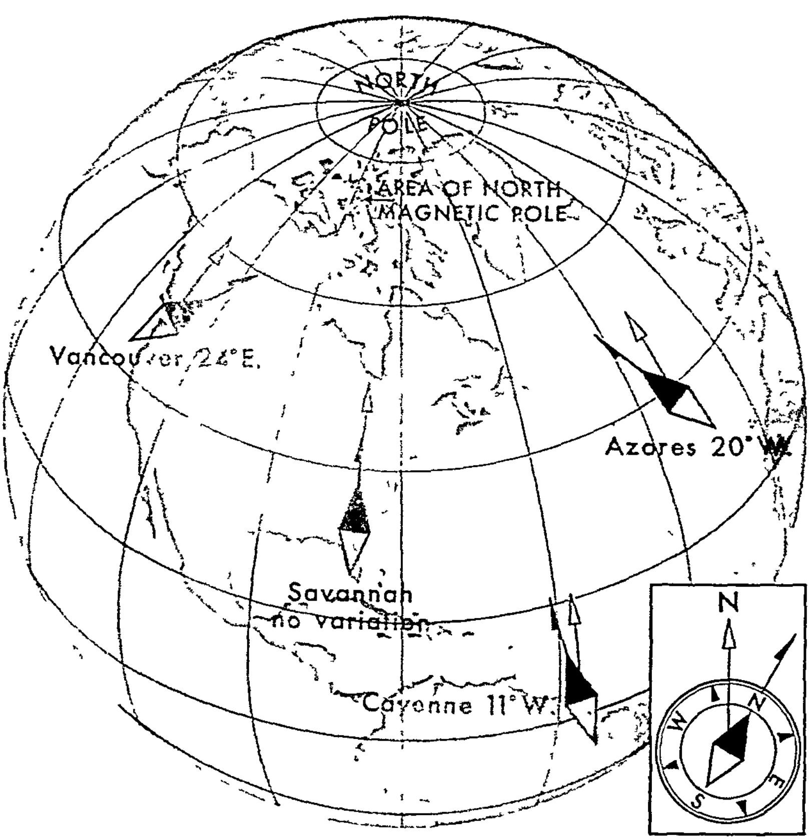
AN EARLY COMPASS

This is how a compass of the 12th century may have looked A magnetized iron needle was held up by wooden buoys in a bowl of water The arrow shaped head of the needle pointed north.

Once men learned how to use iron in this way, they had the handy device we call the *magnetic compass* It was especially helpful to sailors They had been afraid to leave sight of land and sail across unknown seas until they had a good direction finder to guide them

Nature provided the first magnetized iron in the form of a piece of magnetic iron ore called a *lodestone* We do not know when men first learned that a lodestone showed directions, but a form of ' floating" compass was in use in Europe by the 12th century With it, mariners could sail boldly to new lands be-

HOW MAGNETIC COMPASSES SHOW NORTH



The needle of the magnetic compass indicates the general direction of north, but in most parts of the world it points somewhat east or west of true north. In the picture above, single-barbed arrows show compass headings; double-barbed arrows show true north. The angle between them is the variation for that area. The inset diagram shows a simplified compass card.

yond the oceans. The magnetic compass helped Magellan and Columbus make their historic voyages of discovery and aided men in opening new trade routes.

How a Compass Shows Directions

A Boy Scout's pocket compass works on the same principle as the first crude compass. Instead of a lodestone and a wood splinter, it has a magnetized needle that swings freely on a pivot to indicate north. Larger compasses have two or more parallel needles attached to the under side of a disk called a *compass card.*

The magnetic compass works because the earth itself is a huge magnet. Connecting its magnetic poles are somewhat irregular *lines of force,* like those of a bar magnet (*see* Magnet). The earth's magnetic poles are oval areas about 1,000 miles from the geographic poles. There the lines of force are vertical—straight down into the earth. Some distance from the magnetic poles, the lines of force are more or less parallel to the earth's surface.

The compass needle simply aligns itself with these lines of force. In a few places. where lines of force happen to lie along meridians, the compass points to true north. Everywhere else it points east or west of true north. The difference in degrees between true north and "magnetic" north is called *variation* by mariners and *declination* by surveyors. The "compass rose" pictured in the article Navigation shows how variation is indicated on navigational charts.

The magnetic compass is useless in polar areas because lines of force are nearly vertical there. In these areas the sun and stars must be used to tell directions. Large deposits of iron ore in other regions may also make the magnetic compass useless. Lines of force set up by such deposits may affect the compass needle more than the earth's magnetism.

A compass card usually has two sets of direction pointers. The first set consists of 32 *points.* The four principal, or *cardinal,* points (north, east, south, and west) are marked on an inner circle as N, E, S, and W. Between these lie the *intercardinal* points such as northeast (NE). Further division gives such points as north-northeast (NNE). A final division is indicated by the word *by,* as north by east (N by E). Naming all the points of the compass in their order is called "boxing the compass." The 32 points in clockwise order from north are as follows:

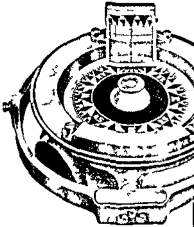
N, N by E, NNE, NE by N, NE, NE by E, ENE, E by N, E, E by S, ESE, SE by E, SE, SE by S, SSE, S by E, S, S by W, SSW, SW by S, SW, SW by W, WSW, W by S, W, W by N, WNW, NW by W, NW, NW by N, NNW, N by W.

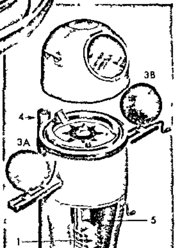
Surveyors, navigators, and others need more exact indications of direction than these, and so they use degrees. The compass card has 360 degrees marked on an outer circle. North is 0° (or 360°), east 90°, south 180°, and west 270°.

Magnetic Compasses Aboard Ship

Today most large ships steer by gyrocompass but they carry a magnetic compass as well (*see* Gyroscope). Navigators use it to check the accuracy of the gyrocompass and for steering if the gyrocompass fails. The magnetic compass is usually carried in a stand called a *binnacle.* The binnacle holds a compass bowl with gimbal rings that keep the bowl level when the ship rolls. The compass card with its needles is mounted on a pivot in the center of the bowl.

A COMPASS AND ITS BINNACLE





Above we see a compass bowl with its card. The reflector enlarges the numbers for easy visibility. At the right, we see the hood lifted to show how the stand (called a binnacle) supports the bowl. The hood shields a light that illuminates the card at night. The numbered magnets compensate the compass. The fore and aft magnets (1) and the athwartship magnets (2) offset the ship's permanent magnetism. The quadrantal spheres (3A and 3B) and the Flinders bar (4) cancel temporary magnetism picked up as the ship travels. The heeling magnet (5) compensates for shifts of magnetic force when the ship rolls.

On the forward inside edge of the compass bowl is a vertical line called a "lubber's line." This marks the "dead ahead" point of the ship. To steer, the helmsman watches the mark for his course (such as 70°) on the compass card, keeping it always opposite the lubber's line.

Effects of Ship's Magnetism

Magnetic compasses aboard ship are affected by the magnetic force of the ship itself. A steel ship is a huge magnet, drawing its magnetism from the earth during construction. Its north-seeking pole is on the part that pointed north when the ship was built. If a ship faced northeast in the shipyard, its north seeking pole is on its port bow. The effect of this magnetism is called *deviation*. Variation and deviation together pull the compass away from true north by an amount called "compass error."

The navigator can remove most of the deviation by "compensating the compass." To do this, he takes his ship to a "range." Here he lines up the ship with markers that indicate the four cardinal directions. Then he "swings ship"—that is, he pivots the ship so that the bow points to each of the markers in turn. As the ship pivots, he removes the deviation on each heading by placing counter-acting magnets in the binnacle. These offset the deviation by attracting the compass in an opposite direction.

COMPASS PLANTS The ordinary position of a leaf is approximately horizontal. But in regions of intense sunlight and dry air certain plants, such as the Australian eucalyptus, have come to turn their leaves edgewise to escape the drying heat of the midday sun. To obtain the needed light, the leaf turns its flat surface to the morning and evening rays. As a result the leaves point either north or south, two of the four cardinal directions and so such plants are called compass plants. The rosinweeds of the prairie and the prickly lettuce of waste ground are among the most common of the compass plants of America.

COMPROMISE OF 1850 At the close of the Mexican War in *1848*, the United States owned vast stretches of territory without local government. All the land now included in the states of New Mexico, Arizona, and California was still unsettled. But in 1848 gold was discovered in California. Thousands of people, chiefly from the Northern states, rushed to the gold fields. In a few months some 80,000 adventurers had settled in the new mining region.

To maintain order and administer justice in these settlements, an established government was needed. California asked to be admitted to the Union as a "free state"—one which would not permit slavery. But the United States had entered the war with Mexico largely to satisfy the South, since the South wanted new territory which could be divided into slave states. If Congress granted California's request, it would run counter to Southern interest.

Throughout the South protest meetings were held. Senator Toombs of Georgia declared in Congress, "I avow in the presence of the living God that if you seek to drive us from California, I am for disunion." The Northern states were equally insistent that slavery should not be extended. All but one Northern state legislature demanded that Congress should ban slavery in the new territory.

Civil war seemed inevitable when Henry Clay offered a compromise. Other points were in dispute, and Clay proposed that each side yield something. The North should allow New Mexico and Utah to organize as territories with no mention of slavery and give the South a stronger fugitive slave law. The South should accept California as a free state and allow prohibition of slave trade in the District of Columbia.

All spring and summer of the year 1850 the fight over these measures was waged on the floors of Con-

gress. The aged Webster supported Clay. He had been opposed to the war with Mexico, but that was a thing of the past and his aim was to preserve the Union. In his famous Seventh of March speech he declared that slave labor could never be profitable in New Mexico and the North would be losing nothing by granting this concession. It was not necessary to exclude it by law of Congress; it was already excluded by "the law of nature." The antislavery sympathizers of the North felt that Webster had become a traitor to the cause of liberty. Their condemnation is shown in the poem 'Ichabod', by the Abolitionist poet, Whittier:

From those great eyes
The soul has fled
When faith is lost, when honor dies,
The man is dead.
Then, pay the reverence of old days
To his dead fame.
Walk backward, with averted gaze,
And hide the shame.

After a fight of eight months Webster and Clay secured the passage of the laws which are known as the Compromise of 1850. This measure did not prove, as Webster had hoped, "a finality that would give peace to a country long distracted by the quarrel over slavery." It merely postponed the inevitable Civil War for another ten years. This ill-fated compromise was the last service rendered by Webster and Clay to their country, for both died in 1852.

CONCORD, MASS. About 20 miles northwest of the city of Boston lies the beautiful little town of Concord, famed for its historical and literary associations. It is more than 300 years old, having been settled in 1635. Its fine old homes and quiet elm-shaded streets reflect the dignity and charm of colonial days. Hundreds of tourists visit Concord, for here was fought one of the opening battles of the War for Independence (*see* Lexington and Concord, Battle of). Here also may be seen the homes of a group of famous American authors.

In the Old Manse, built by the Rev. William Emerson in 1766, Ralph Waldo Emerson wrote some of his best works. Nathaniel Hawthorne added to its fame by his 'Mosses from an Old Manse'. Near Emerson's later home on Lexington Road stands Orchard House, the home of the Alcotts, where Louisa M. Alcott wrote her famous stories and where her father, A. Bronson Alcott, lived while he conducted (1879–88) the Concord School of Philosophy in a building nearby. The happy family life depicted in 'Little Women' refers to an earlier residence in a little house close by, known to them as the Hillside. Hawthorne later obtained possession of it and renamed it Wayside. Meg's Dovecote in 'Little Women' is the Alcott cottage on Main Street, in which the family lived when they first came to Concord. On the same street is another house which the wandering family occupied for a time and which later became the home of Henry D. Thoreau, the famous author of 'Walden'. All these literary friends—Emerson, Thoreau, Hawthorne, and the Alcotts—now lie in the beautiful Sleepy Hollow Cemetery, on the outskirts of the village. Population (1950 census), 2,299.

CONCORD, N. H. From the center of Concord rises New Hamsphire's green-domed granite Statehouse. Other government buildings rise about it from wide green lawns. The business district surrounds this area.

Concord, situated amid fertile fields and profitable granite quarries, lies on the west bank of the Merrimack River about 75 miles northwest of Boston, Mass. It is a transportation and financial center. Employment is offered in railroad shops, in printing, and in manufacturing electrical equipment, leather goods, and silverware. State institutions border the city. Nearby are Bear Brook State Park, St. Paul's School for boys, and the birthplace of Mary Baker Eddy, founder of the Christian Science movement. The former home (now a museum) of Franklin Pierce, 14th president of the United States, and the Historical Society building are within the city.

Settled as Rumford in 1727, the site was renamed Concord in 1762. It was made the state capital in 1808. The Statehouse, built in 1819, was remodeled in 1866; an annex was added in 1911. Population (1950 census), 27,988.

BRITISH RETREAT FROM CONCORD

On the morning of April 19, 1775, American minutemen, standing at Concord Bridge, "... fired the shot heard round the world." The redcoats fired first, then retreated under American fire. The patriots firing from roadside cover made the retreat costly.

The ARTIFICIAL STONE *of the* CONSTRUCTION INDUSTRY

CONCRETE The artificial stone called *concrete* is one of the most widely used building materials It is relatively cheap long lasting and can be molded to any needed shape It can be made porous or watertight heavy or light and will harden to a stonelike substance even under water It is made into sidewalks roads bridges dams buildings of all kinds dry docks and many other useful things

Concrete is a mixture of *aggregates* (sand gravel crushed stone slag and similar materials) *cement* and *water* The cement most used in concretes is portland cement (for manufacture and types *see* Cement) The water and cement form a paste that coats each piece of aggregate and fills all spaces between them The paste hardens bonding the whole into a hard mass

Aggregates

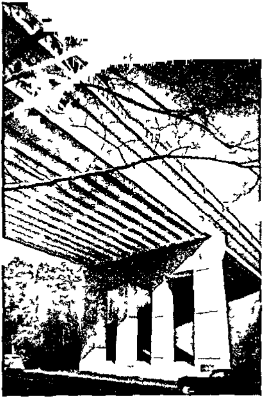
There are both *fine* and *coarse* aggregates Fine aggregates are particles that measure ¼ inch or smaller in the largest measurement coarse aggregate pieces range from ¼ to 6 inches and larger No piece of coarse aggregate should be more than one fifth the thickness of the finished concrete Aggregates and water must be clean and free of organic matter

Ordinary concrete weighs about 150 pounds per cubic foot Lightweight concretes can be made by adding materials that cause swelling or by using lightweight aggregates such as cinders pumice or expanded clay mica shale slag or slate

Mixing Concrete

For home use in sidewalks walls and basement floors the usual mixture is 1 2 3 (1 part cement 2 parts sand and 3 parts stone or gravel) These are thoroughly blended together either by hand with a shovel or in a mechanical mixer Then only enough water is added to make the mixture stiffly plastic

For small home repairs the dry ingredients of a suitable mixture can be bought already blended To make it ready for use it is only necessary to add water and mix For large jobs concrete can be mixed at the building site or purchased *ready mixed* The latter is prepared at a central plant and carried to the building site in trucks that agitate it to keep it plastic Another concrete is *transit mixed* the dry ingredients for this are put in a mixer mounted on a truck As the truck travels they are blended and water added Water



The first prestressed concrete bridge begun in America was Walnut Lane Bridge in Philadelphia Construction began in 1949 The bridge completed in late 1950 was dedicated in 1951

may be kept from the mix until the truck is near or reaches the building site

Placing and Finishing Concrete

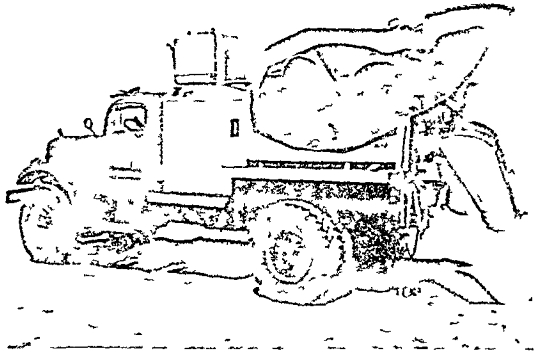
A properly mixed concrete will not pour It must be *placed* It is placed into forms which determine the shape the casting is to take Forms may be made of lumber plywood or metal They must be oiled or moistened to prevent the hardened concrete from sticking to them A spade or other tool is worked up and down in the concrete shortly after it is placed to remove entrapped air The concrete is then *compacted* by tamping the surface or by the use of mechanical vibrators

Excess concrete is removed by *screeding*—advancing a straightedge (such as a 2 by 4) along the top of the form with a sawing motion A relatively smooth nonskid surface is achieved by *floating*—smoothing and grading by gently working the exposed concrete with a light metal wood or cork tool having a flat surface called a float Smoother surfaces are made by working with a steel trowel—*troweling* A rough nonskid surface is given by *brooming*—brushing the almost hard concrete with a hair or wire-bristled brush

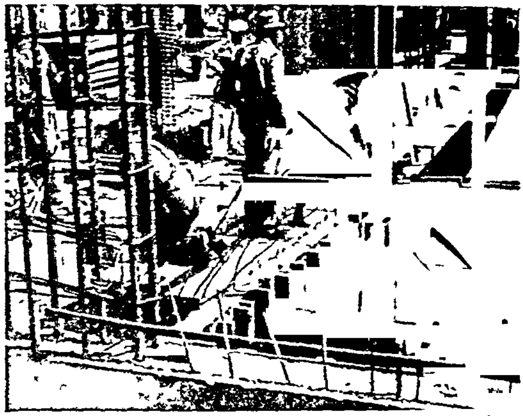
The Strengths of Concrete

The chief cause of poor strength in concrete is the use of too much water in the mix For ordinary con-

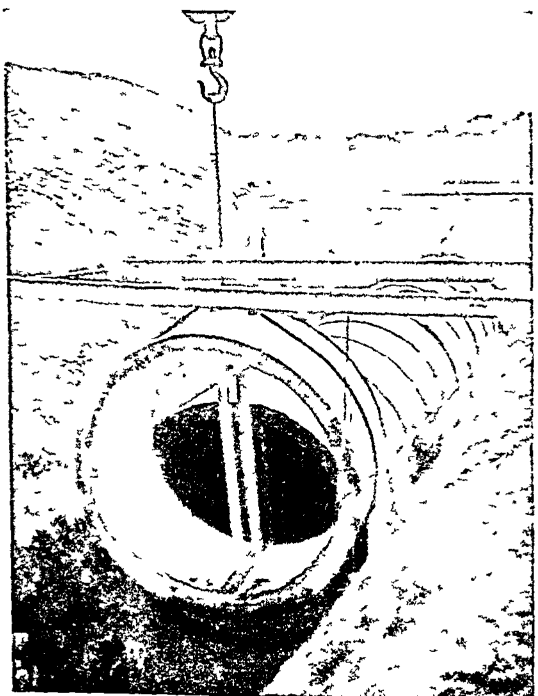
TWO PRINCIPAL WAYS OF USING CONCRETE



A side of this truck-mounted mixer has been cut away to show how aggregates, cement, and water are mixed as the truck travels. Such concrete hardens into position at the building site.



The ends of reinforcing steel rods rise above sections of concrete walls that have hardened in place. The workmen are readying the surfaces for placing the next higher sections.



The big piece of concrete pipe being lowered into position at Wright Field, Dayton, Ohio, was made in a factory and brought to the field. Such concrete is called "precast."

crete the proportion of water is six gallons (less if the sand is wet) to one bag (94 pounds) of cement. This makes a stiffly plastic concrete that in the *slump test* (the fall of concrete placed in a cone of prescribed size when the cone is removed) slumps but does not lose its cone shape. A too-wet mix is sloppy; in it the heavier aggregates sink to the bottom and the cement paste leaches out.

To attain the greatest possible strength, concrete must be properly *cured*. In curing, concrete should be kept wet for three or more days. In winter, freshly placed concrete must not be permitted to freeze. Concrete generates some heat as it hardens. In mildly freezing weather, sand, straw, or tarpaulins thrown over the concrete will keep in sufficient heat to prevent freezing. In severe cold, concrete is kept warm with stoves called salamanders, with warm-air blowers, or with steam.

Concrete's greatest strength is under pressure (*compression*). *Shearing* or *tension* forces tend to crack and break it. Shearing and tension strengths can be increased by *reinforcing* or by *prestressing*.

Concrete is reinforced by placing it about steel rods or wire. Thus the reinforced concrete has the natural strengths of both steel and concrete. Concrete is prestressed by placing it about mechanically stretched steel rods or wires. The stretch of the steel is maintained after the casting has hardened either by the bond between steel and concrete or by anchoring the ends of the steel to the ends of the casting. Still another way is to stretch steel through holes in already hardened concrete. The stretched steel in attempting to resume its natural length, keeps the concrete under great pressure from both ends. This pressure prevents it from cracking and breaking under great shearing and tension forces.

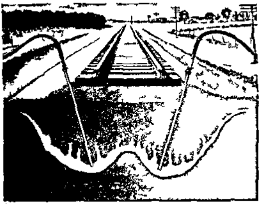
Some Uses of Concrete

Precast concrete is made in several standard pieces cast at factories. These include doorsills, lintels, beams, blocks, bricks, tile, pipe, and decorative pieces. (For a picture of especially fine decorative precast concrete, *see* Baha'u'llah.)

In *tilt-up* construction, walls are cast flat and tilted up into position after they have hardened. *Terrazzo* is a highly polished concrete used in floors. It contains colored aggregates, usually crushed marble. After it has hardened, a special machine grinds off a thin layer of the concrete, thus exposing a surface of colored stones. This surface is then polished until it gleams.

Grout is a fluid mixture of cement and water to which fine sand is often added. Pressure grouting—

PREVENTING A TRACK WASHOUT



A concrete made of cement and water, to which sand is sometimes added is called grout Forced in o pos tion by air or hydraulic pressure it binds the stones into a firm subgrade

forc ng the grout by either a r or hydraul c pressure—is used to firm oil well cas ngs to stab l ze a watery subgrade of ra lroad tracks and to strengthen mason ry walls and dam foundations that ha e becon e weakened Gravity grout ng used to bond p eces of track ballast is done by pouring grout over ballast stones

Soil cement is a concrete used in constructing lightly traveled roads airport runways and irr gation canal linings Its aggregate is the earth found at the con struct on s te This is broken up pulverized and thoroughly blended with cement Water is then mixed in and the whole is compacted So l cement is usually surfaced with bitum nous (black top) materials

Asbestos cement is a l ghtweight concrete used for precast ng shingles sheath ng inter or linings in sulat ng boards and interior decorat ve p eces Asbestos cement can be sawed like wood

Next to bu ld ng construct on roadmaking provides the greatest use for concrete As a road surface con crete offers both a low maintenance cost and a long life Worn concrete can be resurfaced with bituminous materials or with a layer of new concrete

The Portland Cement Assoriat on supported by most cement manufacturing companies develops new and improved cement-using products and methods It carries on a nat on wide program of education on the best ways of us ng cement and concrete Its find ings are made ava lable to all users of cement (For pictures and uses of concrete *see also* Architecture Br dge Bu ld ng Construct on Caisson Dam Roads and Streets)

CONDOR The migl ty condors are the largest of vultures and among the largest of birds Full grown they have a wingspread of from 8 to 11 feet and a body 3 feet long One genus l ves in the h gh Andes of Peru and Ch le above all other animal and plant l fe another genus lives n the S erra Madre of Cal fornia To prevent the Cal fornia condor from disappear ng a special condor reservation is mainta ned in Los Padres Nat onal Forest

These giant b rds have all the unpleasant hab ts of the vulture group but when flying they are among the most majestic of creatures When the condors says Charles Darwin are wheeling in a flock round and round any spot their fl ght is beautiful Near Lima I watched several for nearly an hour without once taking off my eyes they moved in large curves de-

A MODERN USE OF CONCRETE CONSTRUCTION

This modern house is built over a concre e slab as wide and long as the house The precast cinder blocks that form walls are not only self insulating against heat and cold but present a pleasing appearance They can also be painted in any desired color

scending and ascending without giving a single flap." On the ground, however, they are clumsy, and to lift their heavy bodies they require a long running take-off. For this reason they prefer to perch on high cliffs from which they can swoop off easily.

Fewer than a hundred individuals of the California condor exist today. Although it is rigidly protected by state and federal law, advancing civilization has doomed it to extinction. Like all the vultures, it lives on carrion. With wild animals greatly reduced in number, the condor finds it increasingly difficult to obtain a food supply adequate to its great size. Moreover, it lays only one or two eggs in a season. The eggs take about seven weeks to hatch, and the young develop very slowly. They fly when they are about a year old but remain with the parents for three years. The nest is simply a bed of leaves in a cave or under an overhanging ledge of rock in the most inaccessible mountain heights.

Condors are the heaviest flying birds, weighing up to 25 pounds, and only the wandering albatross has a greater wingspread. They are grayish-black, and the wing feathers are edged with white. White patches on the forepart of the underwing are conspicuous as the bird soars overhead. The head and neck are bare of feathers, and the skin is wrinkled and reddish-orange in color. The male Andean condor has a large red comb and wattled neck. The birds have powerful beaks but the huge claws are not formed for gripping and cannot carry prey. The scientific name of the California condor is *Gymnogyps californianus;* of the Andean, or South American, condor, *Vultur gryphus.*

BIRD OF THE MOUNTAIN HEIGHTS

This habitat group in the Chicago Natural History Museum shows a pair of California condors outside their nest on a lofty mountain ledge. The egg is incubated by both birds.

CONEY ISLAND. From Memorial Day until mid-September Coney Island is thronged with millions of New Yorkers seeking amusement and relief from the city's heat. Here a long, broad boardwalk looks out over a beach that is protected from sea erosion by jetties and breakwaters. Boats, subways, buses, and private cars bring fun seekers to the spot.

The shoreward side of the boardwalk is lined with food and drink stands. In back of these are restaurants, dance halls, and two large amusement parks. These last have roller coasters, chute-the-chutes, airplane spins, merry-go-rounds, Ferris wheels, crack-the-whip, a parachute drop, and many other kinds of thrill and fun rides.

Coney Island is a peninsula that hooks westward from Long Island's southern shore. It lies within Brooklyn. At one time Coney Island Creek, a tidal channel now filled in, separated Coney Island from Long Island. Because of the large number of rabbits it once harbored, the Dutch settlers probably called it *Konijn Eiland* (Rabbit Island).

The eastern tip of the peninsula is occupied by the residential area called Sea Gate; the western portion is populous Brighton Beach. All was once called Coney Island, but now only the amusement area and the residential district adjoining it on the north are called by the old name.

Coney Island ~~started as a~~ resort for the wealthy with the building of a hotel in 1829 in what is now Sea Gate. Over succeeding years a pavilion, bathhouse, and more hotels were added. Since the 1870's new highways, rail lines, and the subway have brought millions of the less wealthy to the resort.

CONEY ISLAND BEACH ON A HOT DAY

When summer's moist heat closes down on New York City, thousands seek relief at the beaches. One of the most popular is at Coney Island. Behind the beach lie the boardwalk, refreshment stands, and entertainment facilities of many kinds.

The RISE *and* FALL *of the* CONFEDERACY

CONFEDERATE STATES OF AMERICA Between *Dec 20 1860 and Feb 1 1861* seven southern states declared their withdrawal (secession) from the United States. Three days later at Montgomery Ala they organized a separate and independent government called the Confederate States of America The states that set up this government were South Carolina Mississippi Florida Alabama Georgia Louisiana and Texas Jefferson Davis of Mississippi was elected president and Alexander H Stephens of Georgia was chosen vice-president (*see* Davis Stephens)

The movement for independence was based on the claimed right of any state to secede from the Union The preamble of the new Confederate constitution declared that each state was acting in its sovereign and independent character This right had been asserted at earlier periods in American history (*see* States Rights) Never before however had the issue been charged with the emotional factor of the abolition of Negro slavery The constitution of the Confederate States reflected the then prevailing belief in the South that slavery was the only practicable status for the large Negro population of that section It forbade any legislation impairing the institution of slavery although it did prohibit foreign slave trade

The remainder of the constitution was largely based on that of the Union from which the states of the lower South were withdrawing Among the modifications were a six year term for the president who could not succeed himself The president was given the right to veto separate items of appropriation bills Congress was prohibited from passing any law that related to more than one subject It was also forbidden to adopt a protective tariff on imports

The Three Branches of Government

The legislative branch of the government was the Confederate Congress, consisting of a Senate and a House of Representatives Its work was lessened by adopting all United States statutes consistent with the Confederate constitution On the other hand it had to deal with the difficult problems of war Within the Congress there were no recognized party divisions Members tended to fall into administration and anti administration groups on personal grounds

The judicial system of the Confederacy consisted chiefly of district courts located in the old federal judicial districts The ill-defined jurisdiction of circuit courts was abolished (a step followed half a century later by the United States) Provision was made for a supreme court but it was never organized because of bitter controversies in Congress over its jurisdiction and powers

The executive branch consisted of Departments of State Treasury War Navy Justice and the Post Office The heads of these departments made up the president's Cabinet. Fourteen men held Cabinet offices In order of their terms of service they were secretary of state, Robert Toombs R M T Hunter and J P Benjamin secretary of the treasury C G Memminger G A. Trenholm secretary of war L P Walker J P Benjamin G W Randolph James A Seddon John C Breckinridge secretary of the navy Stephen R Mallory attorney general J P Benjamin Thomas Bragg Thomas H Watts and George Davis postmaster general John H Reagan

Four More States Join the Confederacy

The election of Abraham Lincoln as president of the United States had touched off the series of secessions By the time Lincoln took office four months later the seceding states had taken possession of most of the forts and other public property of the United States lying within their borders In Charleston Harbor however Fort Sumter still garrisoned United States troops The Montgomery government ordered its forces at Charleston to fire on and reduce Fort Sumter The bombardment began on April 12 1861 the fort was surrendered on April 14 On April 15 President Lincoln called for troops to be used against the seceding states Two days later Virginia caught between two warring nations and forced to a choice took its first step toward secession It was followed in turn by Arkansas North Carolina and finally (on June 24) by Tennessee

The four additional states joined the Confederacy Upon Virginia's invitation the capital of the new nation was moved to Richmond in May and June 1861 The number of stars in the Confederate flag originally seven was increased to 13 in recognition of member states plus Kentucky and Missouri Neither of these two states seceded although both sent representatives to the Confederate Congress

The war which began in 1861 continued for almost four years (*see* Civil War American) The 11 Confederate States had a total population of about 9 million of whom some $3\frac{1}{2}$ million were slaves the 23 states remaining in the Union had a population of about 23 million The difference in resources was even greater than the difference in population Most of the industrial power of the nation was in the Union States which had the further advantage of overwhelming naval strength This sea power was effectively used to blockade Southern ports

Some advantages did lie with the Confederacy It stood on the defensive not seeking to conquer the Union States but only to resist efforts to occupy the South It operated on interior lines so that even though its railroads were less in extent and in capacity than those of the North it was able to shift troops from one theater of action to another It had the handicap of its own emphasis on the rights and independence of its individual states Several states asserted these rights at such times and in such ways as to weaken the general effort of the Confederacy

First Three Years of the War

In the beginning of the struggle both sides relied on short-term volunteers—the Union for 90 days the Confederates for one year During the first 12 months of the war despite the dramatic victory of

the first battle of Manassas, or Bull Run, things went badly for the Confederacy. Missouri was lost to the South as was northern Arkansas, more than half of Tennessee, and important positions on the seacoasts. A Union fleet held the mouth of the Mississippi River and threatened New Orleans. In this state of affairs, the Confederacy adopted conscription, a course soon followed by the Congress of the United States

The second year of the war opened with the loss of New Orleans and Memphis and with a Union army in sight of Richmond The course of events was reversed, however, when Stonewall Jackson's brilliant campaign freed the Shenandoah Valley and Robert E Lee took command of the newly named Army of Northern Virginia. Lee drove George B McClellan from Richmond and, in a series of brilliant victories, threatened Washington and crossed the Potomac into Maryland. Meanwhile in the west, Gen. Braxton Bragg drove his Army of the Tennessee into Kentucky, almost to the Ohio River. He was compelled to withdraw, however, after the battle of Perryville (Oct 8, 1862). Earlier Lee had to leave Maryland after the battle at Sharpsburg, or Antietam, on September 16 and 17.

The battle of Antietam was enough of a Union victory to warrant President Lincoln's issuing his preliminary Emancipation Proclamation (*see* Emancipation Proclamation). It was to become effective on Jan 1, 1863, and was to apply only to slaves in states still resisting Union arms at that time. More important it served to make the war a crusade against slavery as well as a conflict to preserve the Union. It thereby effectively ended any possibility of foreign intervention on the Confederate side.

During the remaining years the tide of war slowly turned against the Confederates Lee's invasion of Pennsylvania ended in defeat at Gettysburg. The North gained control of the Mississippi River, cutting off the western South from the remainder of the Confederacy. The railroad lines connecting the central South with the eastern section were cut. In the Shenandoah Valley and elsewhere Union forces deliberately destroyed the South's facilities for producing war supplies.

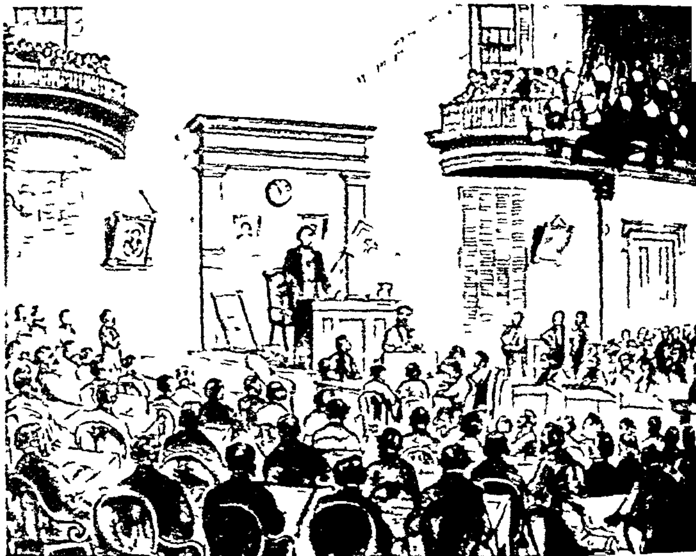
The Southern government had started out with high hope of foreign support, particularly from Great Britain and France. To create an artificial scarcity of cotton abroad, the Confederate government prohibited its export in the early days of the war. Later they could not get it out in sufficient quantities because of the effective blockade. The Confederate States never gained diplomatic recognition as a nation, much less foreign intervention. Europe's chief contribution was in the form of navy cruisers (of which the *Alabama* was the best known). These warships did much to disrupt Union sea-borne commerce

The Confederacy was never able to solve its financial problem. As a result the successive issues of Confederate paper money lost more and more purchasing power until they finally became of no value Estimates of the amount of money printed by the Confederate government range between one and two billion dollars. To this should be added perhaps another half billion dollars of notes and fractional currency ("shinplasters") issued by states, banks, railroads, and other business organizations.

The End of the Confederacy

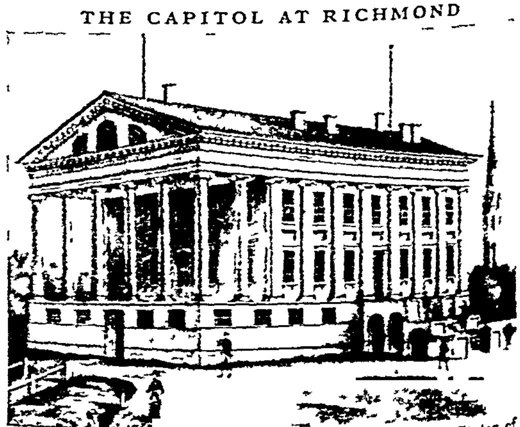
Late in 1864 it became apparent that the Confederacy had no chance to win the war. The fall of At-

CONFEDERATE CONGRESS IN SESSION



The first legislative body of the Confederacy was the Provisional Congress, which convened during 1861. Here the president of the Congress, Howell Cobb of Georgia, presides over a session in the first capital at Montgomery, Ala.

THE CAPITOL AT RICHMOND



In the spring of 1861 the capital of the Confederate States of America was moved from Montgomery, Ala , to Richmond, Va.

THE DEATHBLOW TO THE CONFEDERACY

The Confederacy ended April 9 1865 when the South s general in chief Lee (left seated) surrendered to the Union s General Grant (center seated) at Appomattox Court House Va

lanta was follo ved by the rout of Gen John B Hood s Army of the Tennessee and the virtually unopposed march of Gen William T Sherman to Savannah Unsuccessful attempts were made to negotiate a peace with President Lincoln at Hampton Roads (Feb 3 1865) Three days later President Davis appointed Robert E Lee to the position of general in chief In another six days Wilmington last Confederate port open to blockade runners was closed by the fall of Fort Fisher

Petersburg Va fell on April 2 1865 and Richmond had to be evacuate l Lee fought on for another week then surrendered at Appomattox Court House on April 9 There was still scattered fighting in the Ca olinas in Texas and on the high seas For all practical purposes however the Confe lerate States of America came to its end with Lee s surrender

The Confederate States had to accept the reconstruct on terms imposed upon tl em by the federal government After fulfilling these terms each state was allowed to take its place in the Un on on an equal foot ng w th the otl er states P l t cally the perio l of reconstruction was completed n 1877 l conomi cally the effects of tl e war lasted much longer (Tl is period is discusse l in tl e article Re onstru tion Period *see also* Johnson A1 drew)

CONFUCIUS (*kŏn-fu shus*) (551? 478 B C) O e day about 500 years before Christ the Cl inese philosopl er Confuc us and his disc ples p sse l a graveyard where a woman was weeping at a new ma le grave Tl ey asked the woman why she wept Sl e answere l My husband s father was kille l here by a tiger and my husband also and now my son has met the same fate When they asked her why she did not leave so fatal a spot she answered that in this place there was no oppressive government Remember th s my chil dren sa d Confucius oppressive government is fiercer and more fe red than a tiger

In such teaching and with such wise sayings Confucius spent his life trying to bring men to a right n ode of living and a respect for the teachings of the w se men of old He always said of himself that he was a transmitter not a maker He collected and edite l the poetry the music and the historical writings of the days still older than his own which he cons dered the golden age

Confuc us laid no cla m to being more than a man Yet when he died he was revered almost as a god Ten ples were erected in his honor in every city of China His grave is visited yearly by many pilgrims and l s teachings are deeply respected

Though Confucianism is commonly called a religion it is rather a system of ethics or good conduct Confucius did not talk of God but of goodness He did not teach about any god saving s mply Respect the gods but have as little to do with them as poss ble His entire attention was centered on making men better in th s l fe and his *analects* are wise sayings s m lar to the Proverbs in the Bible He taught men to be honest upright fa thful and obedient to those in author ty His most famous rule of conduct is the negative golden rule which says What ye would not that others should do unto you do ye not unto them Every Chinese particularly the e lucated knows scores of these sayings by heart

Confuc us is tl e Latinized form of this philosopher s Ch nese name which was *K ung fu-tse* meaning the master kung He was born in what is now the province of Shantung of a noble family His father was poor and died when the boy was three years old He was reared by his mother and proved a model son When he was only s x people noted h s fondness for setting out sacrifices and for ceremony He married when he v as 19 years old After his marri age he worked for the governor of h s distr ct first as a keeper of stores and then as an overseer of parks and livestock At the age of 22 he began his l fework as a teacher by establish ng a school He accepted valuable aid from some of his students but he also taught those who could afford to pay only a small fee He woul l not keep a student who would not earnestly try to learn or one who had l ttle ability When h s mother died l e was so stricken with grief that he spent 27 months mourning in s litude

After some ye rs of teaching an l travel he settled in Shantung an l tl ere spent 15 years When he was 52 years old l e was rewarded by an appointment as governor of a province He performed his task so well that a neigl boi ng governor became jealous and plotted h s overthrow Confucius then went into voluntary ex le an l wandered about for 13 years Sa l lened an l d scouraged l e returned to his native state in his 69th year and d ed three years later He had one son and t vo daughters To lay thousands of Chinese claim descent from them Tl e follo vers of his teaching number more than 300 million and they are found not only in China but all over the world

LIVING *in the* HOT, RAINY *Basin of the* CONGO RIVER

The picture shows an African boy fishing in the mighty Congo River. His knife and his fishhook were made by the village blacksmith. His bait can came from a white man's trading station. He wears only a breechcloth because it is always hot in the Congo basin.

CONGO RIVER. Every second of the day and night Africa's great Congo River pours 1,200,000 cubic feet of water into the Atlantic Ocean. Its vast stream has bitten deeply into the ocean floor, and the brown of its silt-filled waters can be seen 30 miles out at sea. Only the flood of South America's Amazon River is greater. The Congo and its headstreams curve 3,000 miles into the heart of Africa. Its many tributaries reach out fanlike many thousands of miles more. They drain the huge Congo basin's 1,600,000 square miles, an area equal to more than half the continental United States.

The huge basin spreads north and south from the equator and east from the Atlantic Ocean two thirds of the way across Africa. The equatorial portion receives the sun's hottest and most direct rays (*see* Climate). Therefore every day of the year has hot summer weather.

For some distance on each side of the equator, the basin receives heavy rainfall, up to 90 inches a year. Moisture and heat make plants and trees grow swiftly, and *tropical rain forests* cover much of the land. The southern part of the basin is high, rolling land. It receives much less rainfall than the equatorial portion, and the land is covered with tall, waving grass. Trees rise along the banks of small, wandering streams. Millions of animals feed here on grass or tree leaves—buffaloes, antelopes, zebras, giraffes, and gazelles. Lions, leopards, and other beasts of prey slink through the tall grasses hunting grass-eating animals for food.

How People Live in the Forest

In the rain forests of the Congo basin, many trees grow until their lowest branches are 60 feet above the ground. Small trees grow close together under the big ones. And under these, bushes and tree ferns grow as high as a house. A matted undergrowth of still smaller plants crowds the ground. Big and little vines twist and turn through this as if to tie it all together. The sun is shut out, and noon is no brighter than twilight in more open land.

The forest teems with animal life. Wild pigs grunt and elephants trumpet. Snakes slither over the ground, up trees, and lie along branches. Gray parrots scream at chattering monkeys. A crocodile climbs a sandy river shoal to sun itself, and out in the stream a hippopotamus' wide back looms darkly just above the surface. Millions of mosquitoes and gnats form humming clouds. Among the insects is the dread tsetse fly. Its bite causes a disease called *nagana* in cattle and sleeping sickness in humans. People cannot raise cattle in the region.

Travel through the vegetation-choked rain forest is difficult. Here and there men have cut paths with big knives and axes. They sometimes follow trails trampled down by elephants and other animals. Travel over the rivers is easier. The native people glide along the Congo in dugout canoes, and steamboats carry passengers and freight.

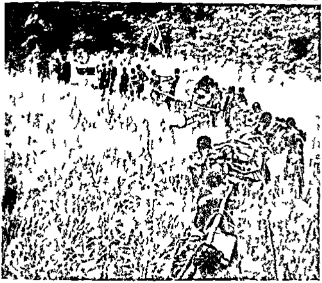
The People of the Congo Basin

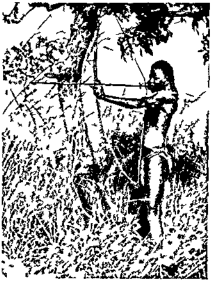
Millions of people live in the Congo basin. Most of them are Negroes. A few thousands are white people. The Europeans came only after Stanley first explored the Congo's course in the 1870's (*see* Stanley). The whites are government, mining, and plantation officials, traders, and missionaries. Most of the basin lies within the Belgian Congo, a colony of Belgium (*see* Belgian Congo).

Among the Negroes, some, called *Negrillos* are Pygmies. They grow only as tall as a 12-year-old American boy. Instead of planting gardens, they get their food by hunting and fishing and by gathering wild fruits and edible plants. They make crude shelters of brush but they stay in one place only a short time. They live deep in the forest (*see* Pygmy).

Most of the people of the Congo basin are Bantu Negroes. The word "Bantu" can mean just one person or many persons. The Bantu are divided into many tribes and speak many languages. The languages are very much alike. Because they live in a hot wet climate, they wear few clothes and construct simple houses. One tribe may build round houses of grass

TRAVELING AND HUNTING IN THE CONGO BASIN





Porters (left) carry a Belgian Congo official and his equipment. He travels in a region where there are no roads. In front of his litter a porter holds aloft a Belgian flag. A Congo hunter (right) draws his bow for a shot at an antelope. He is a hunter for one of the villages. The hunters bring in most of the meat eaten by the Congo people.

and poles and another will construct square houses of palm leaves, poles and reeds. Each tribe uses the material found in its section.

How the Bantu People Live

Most of the Bantu live in villages along the river banks. A typical village has about 25 houses and a working shelter for craftsmen, usually a roofed-over space without walls. The villagers use parts of the surrounding land for garden patches.

Each patch will grow food for only two or three years. In that time the heavy rains wash the plant food from the uncovered soil. When all the land has been worked over, the villagers move to a new site.

To start a new village the men of the tribe first clear the site. They chop out brush and small trees and kill the big ones by burning brush around their trunks. In the moist heat a dead tree quickly rots and falls. In the garden patches the men cut some of the saplings off at the height of their eyes. The women train bean vines on these poles.

To build a house the men cut four saplings with V-shaped crotches at the top. These are the corner posts. They lay long poles from one V to another and lash the roof poles to them. The roof slopes to a point over the center of the house. To make walls the men line the sides with reeds and small poles and tie them in place with vines. Then the women plaster the walls with clay from the river bank. The women and children weave roof mats of long, narrow palm leaves. These too are lashed in place with vines. The palm leaves permit cooling air to circulate through the house, yet they shed the Congo basin's heaviest rains.

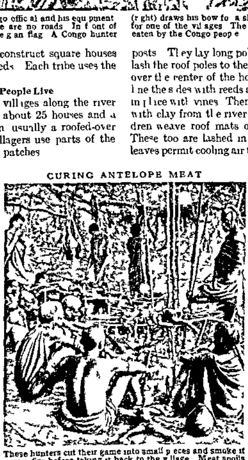
The house has a doorway but no door or window. Its bare earth floor is covered with palm mats. The Bantu use their houses only for sleeping and for a shelter against rain.

The Garden Patches

Women and girls cultivate the garden patches. In them they plant cassava (also called manioc), corn, yams, peanuts and beans. Some villages raise bananas, rice, millet, sugar cane, tobacco and cotton. In the hot, moist air plants grow quickly. As soon as one crop is harvested another is planted in the same ground. The villagers also raise chickens and goats.

But elephants, wild pigs, antelopes and other forest

CURING ANTELOPE MEAT



These hunters cut their game into small pieces and smoke it over a fire before taking it back to the village. Meat spoils quickly in the hot, moist air of the Congo.

and grassland animals like to eat garden plants too. Men guard the garden at night.

The Work of the Men and Boys

The men are hunters, fishermen, and craftsmen. The boys learn these arts from them. The village blacksmith knows how to make iron from iron ore. He can fashion iron into hoes and rakes for garden tools. He makes razors, arrowheads, and spear points. He also is skilled in pounding decorative rings from copper and brass for arms, legs, necks, and noses. Men make canoes by burning out the center of big logs. They weave baskets and other articles of raffia and wicker, and carve combs, figures, masks, and statuettes of ivory and wood. Some pound the soft inner bark of certain trees to make cloth. All the men know how to weave fishing and hunting nets of vines.

The hunting nets are set deep in the forest or grassland. Then men and boys drive monkeys and other small game into them. Most of the fish nets are of the dip variety.

The men hunt with guns, bows and arrows, and spears. Favorite game are wild pigs, antelopes, monkeys, buffaloes, hippopotamuses, and elephants. They use snares and pits to trap game. An elephant pit is dug deep and large, then covered over with a light floor of poles, earth, and underbrush. When an elephant steps on this, the floor breaks and drops the animal into the pit. Hunting trips often last a week or more. The meat of the kill is smoked to prevent it from spoiling.

The men and boys also hunt for palm-nut trees. The nuts grow in great bunches. These are cut down and carried back to the village. There oil is tramped out of the husks under the villagers' bare feet. Palm oil is used by the village women as butter and for cooking. The very hard palm nuts are saved. The men load these into canoes and journey to a trading post, where they trade them for such things as cloth, brass, copper, guns, shells, and salt. The men also cut down timber and sell it to the river-boat captains for fuel.

Evening in the Village

Supper is the Bantu's principal meal. For it the women and girls bring fresh vegetables, bananas, and other produce from the garden. A favorite dish is made of chicken, cassava dough, and green peppers cooked in palm oil.

The children play many games with tops and strings. They have running, swimming, and canoe races, and they test their skill at climbing trees and wrestling. Many of their games grow out of the dangers of forest and grassland living. In these the children play they are hunting, fishing, fighting another tribe, or that a leopard has stolen into the village and run off with a child.

Evenings are busy, happy times. The villagers visit with one another. The women may fashion pots and dishes of clay and bake them in the fire; or they may pound flour for tomorrow's meals from corn and cassava roots in the hollowed end of a log.

On some evenings the village orchestra may give a concert. The musicians play several instruments. Among them is a stringed bow of wood. To play it the musician grips one end between his teeth and hums while he picks at the strings. Women play a special flute by blowing into it through their noses. Other instruments are ordinary flutes, wooden gongs, marimbas, and drums. The Bantu make many kinds of drums. With a big one they beat out messages in code. The message is relayed by the drums from one village to another until it is received at its destination.

Sometimes the villagers hold a dance. Congo life has many reasons for joy or lament. A dance may celebrate the birth of a new baby, a victory over an enemy tribe, or mourn the death of one of the villagers. Dancing begins in the evening, and it may continue until the sun rises. Village chiefs and witch doctors usually are very fine dancers; sometimes one will dance while everyone else watches.

The Village Chief and the Witch Doctor

A village chief or headman directs the villagers in their work and play. A witch doctor is the religious leader of the village. The villagers think he can heal the sick with incantations, dances, or magic. They believe he can save one person from the evil wishes of another. He makes little bags of fish bones, colored strings, and other things and sells them to the villagers as a protection against evil. And he conducts the initiation of boys into manhood (*see* Magic).

For the initiation he takes boys away from the village. To see their mothers or sisters during the tests would cause the boys to fail. They are taught tribal secrets that only men may know. They endure trials and hardship. At the end of a two- or three-week period, the boys who have satisfactorily completed their tests are accepted as men in the tribe.

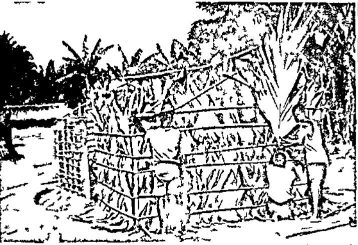
BANTU FISHING NETS

These village women carry two newly made fish nets. They have woven them of vines. Notice that they wear dresses of cloth, bought at a white man's trading station.

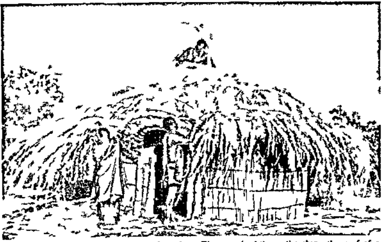
Working for the White Men

White men hire the Bantu men as porters for caravans.

WORK AND CUSTOMS OF THE BANTU



These men are building a house wall of palm leaves (left). Later they will roof the house with straw thatch. The bare poles show the construction before leaves are tied to the walls. The woman (right) is bringing a basket of wood to the village for the evening campfire. Notice how the vine from her head to the basket supports and steadies the heavy load.



The design of the tattooed ridges shown on the face of the woman (left) is peculiar to her tribe. The ridges are formed by packing dirt into shallow cuts. These fester and then heal, leaving the ridges. The men (right) are thatching the roof of a house with grass. They made the walls of reeds. Their village lies in the rolling grasslands.

The porters carry 60-pound loads to forest or grassland places that cannot be reached by boat or truck. In the southern part of the Belgian Congo white men have opened mines from which they take diamonds, tin, copper, cobalt, radium, and uranium. Village men are hired to work the mines. Plantation officials hire the village men to plant and grow such produce as coffee, cacao, sugar cane, oil palms, and rubber. The villagers also are hired as steamer hands, truck drivers, servants, and factory and railroad workers. Some are trained to operate radios and telegraph instruments.

There are few schools in the Belgian Congo. Most of these are conducted by Catholic and Protestant missionaries. Bantu students often return to their villages and start schools of their own, or act as missionaries to their own people. Some are encouraged to continue in school. They become health workers, chemists, doctors, nurses, and clergymen.

The Course of the Congo

The Congo River rises as two headstreams, the Luapula and the Lualaba. The Luapula, the easternmost, rises in a Northern Rhodesian swamp fed by the Chambezi River. It flows northwest to Lake Mweru. It emerges from the lake's northern end as the Luvua and flows northwest. The western headstream, the Lualaba, drains the rich mining area of southern Belgian Congo. It flows directly north to the meeting with the Luvua. At the meeting the half mile-wide Congo is 1,?00 feet above sea level.

The Congo flows 450 miles north, interrupted by a 180-mile stretch of rapids, to the first of the seven

Stanley Falls. In this distance it descends only 200 feet. But in the next 60 miles Stanley Falls drop sharply another 200 feet and swing the river in a northwesterly direction across the equator. At the lower end of the falls lies the river port of Stanleyville. Up to this point the river is known as the Upper Congo.

From Stanleyville to the place where it again crosses the equator, the Congo follows a flattened half circle. It then takes a southwest direction past Léopoldville, the capital of the Belgian Congo, to the sea. The course from Stanleyville to Léopoldville measures 980 miles. In all this distance the river drops only 500 feet. In the 200 miles before it reaches *Léopoldville*, the Congo is four to nine miles wide, and just above the capital it widens into Stanley Pool, about 20 miles long and 14 miles wide. In this 200 miles lie the largest of the river's 4,000 islands.

A WOOD CARVER AT WORK

This artist cuts a design in the side of a drum. When he has finished, animal skin will be drawn taut over the ends of the drum.

Léopoldville is situated 800 feet above sea level just east of the western rim of the Central African Plateau, here called the Crystal Mountains. The river cuts through these mountains and drops in a series of falls and rapids to Matadi, 215 miles away. Matadi, Belgian Congo's main ocean port, stands at the head of the Congo estuary, 95 miles from the sea. The estuary empties the Congo's vast stream into the ocean through a seven-mile-wide mouth.

Some 6,000 miles of the Congo and its tributaries are navigable by shallow-draft, stern-wheel river steamers. Rail lines have been constructed to portage passengers and freight around rapids and falls between Matadi and Léopoldville, around Stanley Falls, and around the 180-mile stretch of rapids in the Upper Congo. The principal *navigable tributaries* are the Kasai, Lomela, Lomami, and Ubangi.

Natural Resources and Industry

Much of the wealth of the Congo basin lies in its mineral deposits. In a huge southern area called Katanga, ores of uranium (used in atomic bombs), radium, copper, zinc, manganese, and other minerals are mined. Gold and silver are found in the mountainous northeast region. In the southwest, along the upper Kasai River, a large part of the world's supplies of industrial diamonds are mined. The most important coal mines lie near the western shore of Lake Tanganyika.

The basin's *industrial development* is devoted mainly to smelting minerals and processing forest and agricultural products. The processing industries include palm-oil pressing and refining plants, cotton gins, textile mills, rubber and sugar refineries, and tobacco and furniture factories.

A HUNTING DANCE AND A GIRLS' GAME

The dancer (left) wears a wooden antelope head. He dances to the throbbing rhythm of tom-toms to bring luck to his next hunt. The girls (right) are playing a game like "Musical Chairs," using corncobs instead of chairs. The cobs are passed from hand to hand. The player who does not have a cob in her hand at a sudden signal must drop out of the game.

The LEGISLATIVE BRANCH *of* GOVERNMENT

CONGRESS OF THE UNITED STATES In January of each year 531 men and women assemble in the nation s capital to represent the people of all the states These men and women are the members of Congress—96 in the Senate and 435 in the House of Representatives They have been elected by the voters to make the laws of the United States

The authority for Congress is found in Article 1 Section 1 of the Constitution It states that All legislative Powers herein granted shall be vested in a Congress of the United States which shall consist of a Senate and House of Representatives

The establishment of two legislative bodies was the first resolution adopted by the Constitutional Convention The members of the Convention wanted to achieve a balance between the large states and the small states First they favored the large states by deciding that House representation should be based on population Then they allotted two senators to each state regardless of population thus giving small states equal voting power with large ones The establishment of two chambers also enabled one body to check the actions of the other thereby lessening the danger of rash legislation

Membership in the House and Senate

A member of the House of Representatives or lower house must be at least 25 years of age and seven years a citizen Each member is elected for a term of two years and the entire membership comes up for re-election the first week of November in even-numbered years

Each state has one seat in the House with 387 additional seats apportioned among the states according to their population Membership in the House grew from 59 to 435 as the population of the nation increased In 1930 however Congress fixed the total number at 435 subject to reapportionment after each ten year census Most representatives are elected from a particular district although some are chosen *at large* in a state-wide election

A member of the Senate or upper house must be at least 30 years old and a citizen for nine years He is elected for six years Terms are staggered to bring up one third of the members (32) for re-election every two years Since the 17th Amendment passed in 1913 senators have been elected by popular vote Prior to that they were chosen by the state legislatures

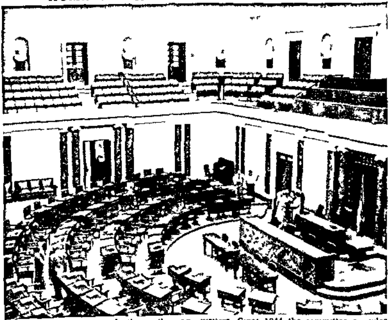
Until 1955 senators and representatives alike were paid $12 500 a year plus $2 500 yearly for expenses In 1955 their salaries were raised to $22 500 and the expense allowance was dropped

The Constitution requires Congress to assemble at least once in every year This is the regular session Special sessions may be called by the president whenever he desires Congress adjourns all sessions regular or special at its own discretion When Congress assembles for its first regular session following the two-year elections a new Congress is said to exist Since the first Congress of 1789–90 each new Congress has been numbered consecutively (For the proper forms of address in writing to a congressman *see* **Address** in the FACT INDEX)

The Powers of Congress

The legislative powers of the two chambers are equal except in the cases specified by the Constitution Only the House can originate bills for raising revenue although the Senate may propose amendments To the Senate alone is given the power to ratify treaties which must be approved by a two thirds vote The Senate must also approve appointments to important

HOME OF THE UNITED STATES SENATE



The Senate Chamber is in the north wing of the Capitol Democrats sit on the left side of the room Republicans on the right. *Newspapermen* occupy the section of the gallery directly behind the vice-president s desk The remaining seats in the gallery are for visitors Since 1944 the committee on rules and administration has prohibited the taking of all types of pictures inside the chamber while the Senate is in session (For a picture of the House Chamber during a joint session *see* United States Government)

offices made by the President. The House has the power of impeaching federal officers, but after it has made an accusation the Senate sits as a court of justice to try the case (*see* Impeachment).

Many of the powers of Congress are carefully enumerated in the Constitution (*see* United States Constitution). Its remaining powers stem from two so-called elastic clauses. The first clause grants Congress the power to "provide for the common defense and general welfare of the United States." The second allows Congress "to make all laws necessary and proper for carrying into execution" all its specified powers as well as the powers vested in the executive and judicial branches of the government. These clauses give Congress control over many areas of responsibility that could not be foreseen when the Constitution was written in 1787.

STANDING COMMITTEES OF CONGRESS

Committees Common to Both Houses

Appropriation	Interior and Insular Affairs
Armed Services	Interstate and Foreign Commerce
Banking and Currency	Judiciary
District of Columbia	Post Office and Civil Service
Government Operations	Public Works

Other Senate Committees

Agriculture and Forestry	Foreign Relations
Finance	Labor and Public Welfare
Rules and Administration	

Other House Committees

Agriculture	Rules
Ways and Means	House Administration
Foreign Affairs	Merchant Marine and Fisheries
Education and Labor	Un-American Activities
Veterans' Affairs	

Leadership and Rules of Procedure

The vice-president presides over the Senate. The House chooses its own chairman, called the *speaker*, from among its members. He is usually the recognized leader of the majority party in the House. Each chamber also has its *floor leaders* of both the majority and minority parties, who try to keep their party machines in smooth running order and "line up" the members when some measure requires their support. The floor leaders are assisted by members called *whips*, who bring in absent legislators when an important measure comes up for vote.

Each branch of Congress has its own rules of procedure. Because it is so large, the House restricts speeches to one hour. The Senate allows unlimited debate, ruling only that a senator may not speak twice in a day on the same subject. Sometimes a minority group of senators holds the floor for days or even weeks to prevent a bill from coming to a vote. This method of defeating a bill is called *filibustering*. It can be stopped only by a vote of *cloture* supported by two thirds of the membership.

Committees Do Much Work

Any member of the House or Senate may introduce a bill into the chamber of which he is a member. The bill is then referred to the *standing committee* which deals with its particular subject. The committee considers the merits of each bill and then votes on the action to be taken. It may report the bill favorably or unfavorably to the chamber. It may amend the bill or rewrite it completely. Often the committee votes to "lay the bill on the table." In effect, this action "kills" the measure unless the chamber votes to overrule the committee and consider the bill. Of the 15,000 different bills usually introduced during the lifetime of a Congress only about one seventh are enacted into laws.

The Senate has 15 standing committees; the House, 19 (*see* table at top of page). Memberships vary from 13 to 45 with each party generally represented in proportion to its strength in the chamber.

One of the most powerful committees is the Rules group in the House. This committee controls the order in which bills are acted upon by the House and also limits the time for debate. Another important group is the House Ways and Means Committee which introduces all tax bills. The Senate Foreign Relations Committee reflects the special powers over foreign affairs granted the upper house.

In addition to its standing committees, which are permanent, each chamber has its *special*, or *select*, *committees*. These dissolve when they have served their purpose. Special committees are often appointed to make inquiries or conduct investigations.

A third type is the *joint committee*. These are permanent groups which include members of both Senate and House, such as the Joint Committee on Atomic Energy. *Subcommittees* are smaller groups within a committee appointed for a definite task.

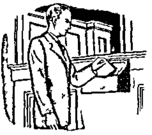
A committee may summon experts to give advice or request Cabinet members to appear and give opinions and answer questions. Representatives of manufacturers' associations, labor unions, farmers' organizations, reform groups, and other bodies are often admitted to argue for or against measures in which they have a special interest. These organizations

PARTY STRENGTH IN CONGRESS

	Senate		House	
	Dem.	Rep.	Dem.	Rep.
83d 1953–54	47	48	212	221
82d 1951–52	49	47	235	199
81st 1949–50	54	42	263	171
80th 1947–48	45	51	188	246

NOTE.—Totals do not include congressmen elected in special elections, those from minor parties, or vacant seats.

HOW A BILL BECOMES A LAW IN THE UNITED STATES

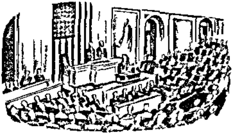


A Congressman has drafted a b ll. He d ops t nto the hoppe attached to the Clerk s desk.

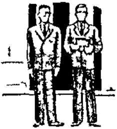
The Parl amen a an efe s the b l to a comm ttee The Ch ef Cle k numbers t t s p n ed that n ght

The comm ttee hears nte ested pe sons d scu ses the b l amends t and eports back to the House

Its title and number are added to the proper Calendar In due t me s b ought befo e the House

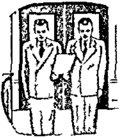


The Ch ef Cle k eads the b l o the House Debate beg ns amendments a e offe ed A vo e s taken and the b ll s pa sed



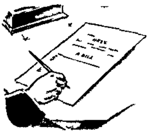
Two cle ks f om the House convey (message) the b l to the floor of the Sena e

A Senate comm ttee d aws up amend men s. The Senate debates vo es to ac cept the rev sed b ll



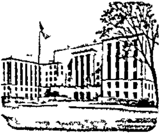
The b l s messaged ba k to the House The House app oves some Senate amend ments rejects o he s

Rema n ng d ffe ences a e ad usted by a conference comm t ee Both houses vote to accept the result



The b s enrolled (p nted on parch ment pape) The Speaker s gns t then the P es dent of the Sena e

The en ol ed b l s ca ed to the Wh te House The P es dent s s gna ure makes the b ll a law



The Sec eta y of Sta e o de s the new act publ shed The S ate Department p eserves the s gned b ll

lls that orig nate in the Senate go through a s milar proce-ure Most legislative bodies require three read ngs of every ll Th s procedure originated in the Brit sh Parl ament where it was introduced to prevent hasty and ill cons dered lawmak ng In the United States Congress the first read ing (when the b ll is introduced) is by t tle only For the second read ng (shown above) it is read in full The third reading (just before voting) is aga n by title only

NUMBER OF REPRESENTATIVES FROM EACH STATE			
Alabama	9	Nevada	1
Arizona	2	New Hampshire	2
Arkansas	6	New Jersey	14
California	30	New Mexico	2
Colorado	4	New York	43
Connecticut	6	North Carolina	12
Delaware	1	North Dakota	2
Florida	8	Ohio	23
Georgia	10	Oklahoma	6
Idaho	2	Oregon	4
Illinois	25	Pennsylvania	30
Indiana	11	Rhode Island	2
Iowa	8	South Carolina	6
Kansas	6	South Dakota	2
Kentucky	8	Tennessee	9
Louisiana	8	Texas	22
Maine	3	Utah	2
Maryland	7	Vermont	1
Massachusetts	14	Virginia	10
Michigan	18	Washington	7
Minnesota	9	West Virginia	6
Mississippi	6	Wisconsin	10
Missouri	11	Wyoming	1
Montana	2		
Nebraska	4	Total	435

are sometimes called *special interest*, or *pressure*, *groups*. They often maintain agencies in Washington to impress their views upon Congress. Such agencies are called *lobbies* because their members once swarmed in the lobbies of Congress to talk to the legislators. All such agencies must be formally registered as lobbyists.

Two other types of committees are also used in Congress. The entire House or Senate may meet as a *committee of the whole* to debate a bill informally. When the members of a single party have a secret meeting it is called a *caucus*. Caucuses are held to appoint party floor leaders, to nominate a speaker, or to discuss policy or legislation.

How Laws Are Passed

When a committee returns a bill to its chamber, the measure is put on a *calendar* which is simply a list of bills in order. At the proper time, the bill comes up for action. Its merits are debated and amendments, if any, are proposed and voted on. The bill as amended is now ready for a vote. A majority of all the members of the chamber—a *quorum*—must be present when a vote is taken. Usually the vote is counted by "ayes" and "noes" or by standing. When a *roll call* is asked for, the vote of each member is recorded. If two members, one for and one against a bill, are absent, they may have their votes counted as a "pair."

When a bill has been passed in one chamber, it goes to the other chamber where the same procedure is followed. If changes are made in the second chamber, the bill is returned to the first to be considered again. If the two chambers fail to agree, a *conference committee*, made up of members from both chambers, attempts to resolve the differences.

When a bill or a *joint resolution* has been passed by both chambers it goes to the president. If he signs it, the measure becomes a law. If he vetoes it the measure may still become a law if both chambers pass it a second time by a two-thirds vote (see Veto). A *concurrent resolution* is an expression of feeling and is not signed by the president.

All speeches and proceedings in Congress are reported in the 'Congressional Record'. Often a member gets "leave to print" material or *extended remarks* in the 'Congressional Record' which have not been read or spoken on the floor of Congress. (*See also* United States Government.)

CONJUNCTION. Compared with the enormous number of nouns, verbs, adjectives, and adverbs in the English language, there are very few conjunctions. Nevertheless conjunctions are exceedingly useful words, and they save us a great deal of time. Suppose we want to say that John, Frank, and Mary each has a sled. If there were no conjunctions, we could not make this statement clear without saying "John has a sled, Frank has a sled, Mary has a sled." But by the use of the little word *and* we are able to avoid all this repetition and make a single statement convey our meaning.

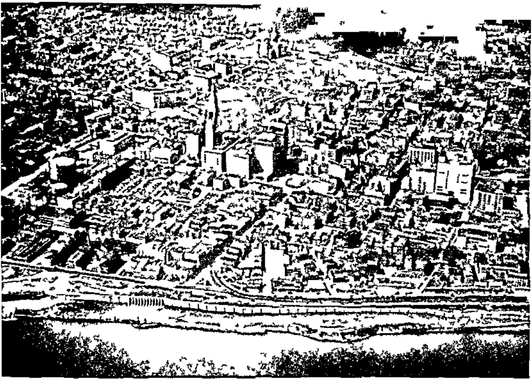
Conjunctions then are words which connect. They get their name from a Latin word meaning "to join with" or "connect." They may connect single words or entire phrases, clauses, and sentences. Those that connect elements of the same grammatical value or rank are called *co-ordinate* conjunctions. Those that connect clauses of different grammatical rank are called *subordinate* conjunctions; many of these are adverbs used as conjunctions, and so are also called *conjunctive adverbs* (*see* Adverb).

Besides merely connecting, conjunctions are used to express various relations. Co-ordinate conjunctions may denote addition (*also, and, moreover*); separation or choice (*either, or, neither, whether*); opposition (*but, however, whereas, yet*); result or effect (*so, therefore, thus, hence*). Subordinate conjunctions may denote time (*when, after, while*); place (*where, whence*); cause (*because, for, as*); condition or supposition (*if, though, unless*); purpose or result (*lest, that, in order that*); comparison (*than, so, as*).

Many conjunctions are used in pairs: *either—or, both—and, though—yet, not only—but also*. These are called *correlative* conjunctions.

One of the most common mistakes is the use of *like* to introduce a clause. *Like* is not a conjunction, and should never be followed by a subject and predicate. It is correct to say "He looks like a strong boy," but not "He looks *like he* is strong." In the second sentence the conjunctive phrase *as if* should be used instead of *like*. *Like* should always be followed by a noun or other substantive.

Conjunctions are important aids to clear expression. Unless a writer masters these small "thought carriers" he will never achieve a lucid and logical style. They play a great part in legal documents, and many a lawsuit has turned upon a single "but."



Dominating Hartford is Travelers Tower New England's tallest structure In the background is the State Capitol. Hartford is Connecticut's largest city and an important insurance and industrial center

CONNECTICUT—*The* "CONSTITUTION STATE"

CONNECTICUT (*kŏ-nĕt'ĭ-cŭt*) More than 300 years ago the leaders of a colony in southern New England adopted the Fundamental Orders of Connecticut This was one of the first documents of government written by the American colonists themselves For this reason Connecticut became known as the Constitution State

Another nickname the Nutmeg State comes from a humorous story about the shrewdness of some of the early Yankee traders It was said they made and sold wooden nutmegs as genuine thus making a very nice profit The real name of the state comes from the Connecticut River The Indians called this stream *Quonehtacut* meaning long river

Connecticut is the southernmost of the New England states In area it is 46th among the states in the Union Only two other states Rhode Island and Delaware are smaller Although small in area Connecticut ranks 28th in population and is one of the most densely populated states The great majority of its people live in towns and cities rather than on farms and about 45 per cent of its working population is engaged in manufacturing

Manufacturing—the Main Industry

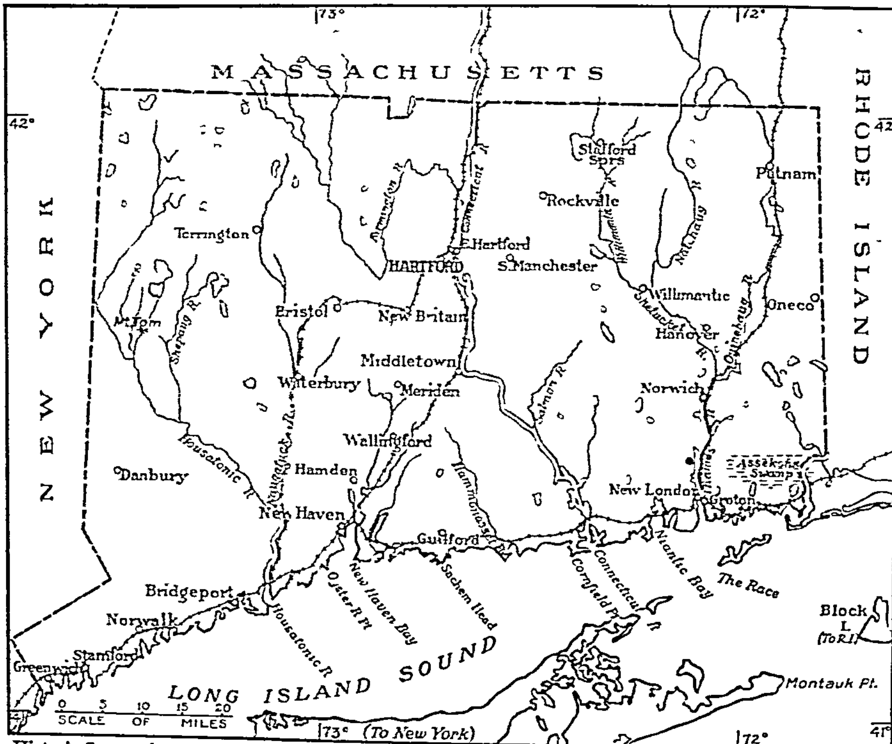
Connecticut's high standing in manufacturing is due to several factors With swift rivers to provide water power industry got an early start The state's inventive and industrious people had the ability to succeed in ventures requiring both manual skill and business enterprise Both raw materials and markets for finished goods were within easy reach

Even in colonial times its location was excellent for trading Along Long Island Sound many sheltered harbors attracted coastwise and Atlantic shipping Nearby was the fast-growing region around New York City a great market for Connecticut manufactures As railroads grew the level coast land of Connecticut gave easy access to all of New England Later rail lines pushing westward through New York State linked Connecticut with the entire nation

Today Connecticut factories lead in manufacturing ball and roller bearings office and store machines electrical apparatus and appliances and men's felt hats It ranks high in the production of small hardware silverware and plated ware These industries have been among Connecticut's specialties for a long time Many forerunners of present industries began before the American Revolution

As early as 173? London hatters were already objecting to the competition of Connecticut-made felt hats Brass buttons and iron nails were made before the middle of the 18th century and during the next

A STATE OF FACTORIES, TRADE, AND FARMS



Historic Connecticut was once an English colony made up of many farm settlements. It is still noted for its many fine dairy, fruit, and truck farms. But its industrial growth since 1750 has made it one of the great manufacturing states in the Union. Today its cities, located mainly along the rivers and Long Island Sound, make everything from pins to office machines. These they sell all over the nation.

three decades silk, woolen, and paper mills were set up. In the American Revolution, Connecticut mines and foundries were important. An iron mine near Salisbury was the chief source of ore for cannon, cannon balls, and chains. The chains were used to block the passage of British ships up the Hudson River.

After the war, new industries sprang up. Between 1804 and 1810, cotton textile mills were put up at Vernon, Pomfret, and Jewett City. In 1812 a woolen mill at Middletown was the first to use steam engines instead of water wheels. After that year Connecticut rapidly became a leading manufacturing state.

Hartford, the capital, is the largest city in the state. Along with New Haven, Bridgeport, and Waterbury, it is a manufacturing center, producing a wide variety of goods (*see* articles on these cities). Stamford is called the "lock city"; New Britain, the "hardware city"; Meriden, the "silver city"; Danbury, the "hat city"; Manchester, the "silk city"; and Willimantic, the "thread city." At Groton the world's first atomic-powered submarine was launched in 1954.

The Merritt and Wilbur Cross parkways go through or within a few miles of the state's largest cities. These express roads stretch from the New York line in southwest Connecticut almost to Massachusetts.

Land and Climate

Connecticut is almost rectangular in shape. It is bounded by Massachusetts on the north, Rhode Island on the east, New York on the west, and Long Island Sound on the south. Across this narrow sound is Long Island, New York.

Away from the coast, Connecticut is covered with rolling and forested hills. Ranges of these hills extend from north to south across the state. In the northwest corner is the beautiful section of low mountains called the Litchfield Hills. Near the middle of the state are the lowlands of the Connecticut River valley, separating the eastern from the western uplands. Along the Sound is a low coastal plain.

Connecticut has three main river systems. Crossing the state from north to south is the Connecticut River. The valley is famous for its beauty and fertile soil. Here the first settlers made their homes, near the site of Hartford. To the east, the Thames River and its tributaries flow southward through low hills.

The western upland section is drained by the Housatonic and Naugatuck rivers. It has many rugged hills covered with timber. In the northwest corner, where the Connecticut-Massachusetts boundary crosses Mount Frissell, is the state's highest point, 2,380 feet.

The state's coast on the Sound has several good natural harbors. The principal one is at New London, seat of the United States Coast Guard Academy. The best water route to the interior is on the Connecticut River. It is navigable from its mouth on the sound to Hartford, 50 miles distant by water. To aid navigation the Federal government has made extensive improvements in the river's channel.

Connecticut's average temperature throughout the year is about 49°F. Its summer average is about 68°, and its winter average is approximately 28°. The annual precipitation is about 45 inches, equally distributed among the four seasons. Both temperature and rainfall are suitable to the growing of good pastures, orchards and vineyards, and field crops.

Farm and Fishery Products

Among the most valuable of Connecticut's agricultural products are milk, tobacco, eggs, hay,

Continued on page 447

Connecticut Fact Summary

CONNECTICUT (Conn.) Name first applied to river, then to state, from Indian word *Quonektacut*, long river. **Nickname** Constitution State. Fundamental Orders drawn up in 1639 established pattern for federal and state constitutions. Sometimes called Nutmeg State.

Seal Three fruited grapevines supported by stakes; state motto on outspread ribbon below.

Motto Qui Transtulit Sustinet (He Who Transplanted Still Sustains).

Flag For description and illustration *see* Flags.

Flower Mountain laurel. **Bird** American robin. **Tree** White oak. **Song** None official.

THE GOVERNMENT

Capital Hartford (since 1665; jointly with New Haven 1701–1875).

Representation in Congress Senate 2. House of Representatives, 6. Electoral votes 8.

General Assembly Senators 36, term 2 years. Representatives 279, term 2 years. Convenes Wednesday after first Monday in January in odd-numbered years. Session limit until Wednesday after the first Monday in June. No limit to special session.

Constitution Adopted 1818. Proposed amendment must be (a) passed by a majority vote in the house of representatives, approved at next assembly by two-thirds vote in each house, and (b) ratified by a majority voting on amendment in special town meetings.

Governor Term 4 years. May succeed himself.

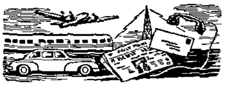
Other Executive Officers Lieutenant governor, secretary of state, treasurer, comptroller, attorney general, all elected, terms 4 years.

Judiciary Supreme court—5 justices. Superior courts—20 judges. All judges nominated by the governor and appointed by General Assembly for 8-year terms.

County 8 counties, each governed by 3 county commissioners appointed by General Assembly, term 4 years.

Municipal Mayor-council plan most common.

Voting Qualifications Age 21; residence in state 1 year, in town 6 months. Literacy test required.



TRANSPORTATION AND COMMUNICATION

Transportation Railroads 800 miles. First railroad Stonington to Rhode Island state line 1837. Rural roads 10 300 miles. Airports 25.

Communication Periodicals 6. Newspapers 87. First newspaper *New London Summary*, New London 1758. Radio stations (AM and FM) 36; first station WCJ, New Haven, licensed Sept. 29, 1921. Television stations 5; first station WNHC-TV, New Haven, began operation June 18, 1948. Telephones 918 100. Post offices 286.

THE PEOPLE AND THEIR LAND

Population (1950 census) 2 007 280 (rank among 48 states—28th); urban 77.6%, rural 22.4%. Density 409.7 persons per square mile (rank—4th state).

Extent Area 5 009 square miles, including 110 square miles of water surface (46th state in size).

Elevation Highest, Mount Frissell on state's northern boundary, 2 380 feet; lowest, sea level.

Temperature (°F.) Average—annual 49°, winter 28°, *spring 47, summer 68, fall 52°*. *Lowest recorded* −32° (Falls Village Feb. 16, 1943); highest recorded 105 (Waterbury July 22, 1926).

Precipitation Average (inches)—annual 45; winter 11, spring 11, summer 12, fall 11. Varies from about 49 in northwest to about 42 in east central.

Natural Features Sand beaches and natural harbors are strung along Coastal Plain on Long Island Sound. Connecticut River and its valley lowlands divide state into two nearly equal sections: western highlands—Berkshire, Norfolk, Litchfield hills and deep narrow valleys drained by Housatonic and Naugatuck rivers; eastern highlands, low wooded hills and Thames River valley. Principal rivers: Connecticut, Farmington, Housatonic, Naugatuck, Thames.

Land Use Cropland 12%, nonforested pasture 9%, forest 60%, other (roads, parks, game refuges, wasteland, cities, etc.) 19%.

Natural Resources *Agricultural*—fertile soil in valleys, carefully utilized highlands suitable for dairy farming. *Industrial*—ample water and hydroelectric power. *Commercial*—excellent geographic location in highly populated area, furnishing ready market for dairy, poultry, and industrial products.

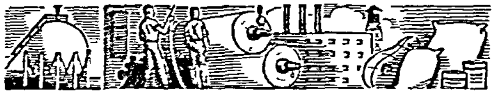
OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living

Major Industries and Occupations 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Manufacturing	35[illegible] 513	4[illegible].5
Wholesale and retail trade	13[illegible] [illegible]77	16.8
Professional services (medical, legal, educational, etc.)	73 783	8.9
Construction	48 572	5.9
Transportation, communication, and other public utilities	43 956	5.3
Personal services (hotel, domestic, laundering, etc.)	41 97[illegible]	5.1
Finance, insurance, and real estate	38 376	4.6
Government	28 145	3.4
Agriculture, forestry, and fishery	24 939	3.0
Business and repair services	19 565	2.4
Amusement, recreation, and related services	6 050	0.7
Mining	537	0.1
Workers not accounted for	10 627	1.3
Total employed	827 807	100.0

Connecticut Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—12th)
Value added by manufacture* (1952), $2,790,887,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
MACHINERY (EXCEPT ELECTRICAL). Ball bearings and roller bearings; office and store machines; metal-working machinery	$387,391,000	8
FABRICATED METAL PRODUCTS ... Cutlery, hand tools, and hardware; metal stamping and coating; heating and plumbing equipment	244,454,000	7
MISCELLANEOUS MANUFACTURES .. Silverware and plated ware; needles, pins, fasteners; small firearms	177,471,000	4
TEXTILE MILL PRODUCTS.... .... Hats (except cloth and millinery); cotton and rayon broad-woven fabrics; woolen and worsted fabrics	175,270,000	10
ELECTRICAL MACHINERY.... ..... Industrial apparatus; appliances	165,361,000	8

*For explanation of value added by manufacture, *see* Census.

B. Farm Products (Rank among states—41st)
Total cash income (1952), $176,518,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Milk............	320,000,000 qts.	1	35
Tobacco.........	23,688,000 lbs.	2	11
Eggs............	40,000,000 doz.	3	30
Chickens........	53,069,000 lbs.	4	28
Hay.............	457,000 tons	5	41
Potatoes........	3,440,000 bu.	6	24
Cattle..........	26,796,000 lbs.	7	45

*Rank in dollar value †Rank in units produced

C. Fish (Rank among states—23d)
(Marine waters and coastal rivers, 1950), catch, 20,226,000 lbs.; value, $2,114,000

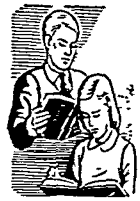
D. Minerals (Fuels, Metals, and Stone)
Annual value (1951), $6,299,000
Rank among states—45th

Minerals (1951)	Amount Produced	Value
Stone.................	2,278,000 tons	$3,360,000
Sand and gravel.......	3,108,000 tons	1,761,000

E. Trade

Trade (1948)	Sales	Rank among States
Wholesale	$1,375,708,000	30
Retail.........	1,975,035,000	21
Service........	171,035,000	21

EDUCATION



Public Schools: Elementary, 699; secondary, 129. Compulsory school age, 7 through 15. State Board of Education composed of 9 members appointed by governor for 6-yr. terms. Commissioner of education appointed by state board for indefinite term. Town boards of education have 3 to 12 members elected for 3-yr. terms. Town and city supts. elected by local boards for 3-yr. terms.

Private and Parochial Schools: 212.

Colleges and Universities (accredited): Colleges, 23; junior colleges, 6. State-supported schools include Univ. of Conn., Storrs (branches—Hartford, Stamford, Waterbury); teachers colleges—Danbury, New Britain, New Haven, Willimantic.

Special State Schools: Mystic Oral School, Groton; Connecticut Institute of the Blind, Hartford; State Training School and Hospital, Mansfield; Home and Hospital for Crippled Children, Newington; Training School, Southbury; The Seaside, Waterford; American School for the Deaf, W. Hartford; 13 vocational schools.

Libraries: City and town public libraries, 199. Bureau of Libraries, Dept. of Education, responsible for aid in developing school and public library service; staff includes consultants for both. Noted special libraries: Hartford Medical Society; Yale Univ., New Haven; Watkinson Collection, Trinity College, Hartford.

Outstanding Museums: Morgan Memorial Museum, Wadsworth Atheneum, both at Hartford; Marine Museum, Mystic; Peabody Museum of Natural History, Yale University Art Gallery, both at New Haven; Lyman Allyn Museum, New London.

CORRECTIONAL AND PENAL INSTITUTIONS

Long Lane School for Girls, Middletown; Connecticut School for Boys, Meriden; Connecticut Reformatory, Cheshire; Connecticut State Farm and Prison for Women, Niantic; State Prison, Wethersfield.

STATE PARKS*†

Black Rock—Sand Dam Pond; Mattatuck Trail (20).
Dennis Hill Area—1,610 ft.; laurel woods; nr. Norfolk (5).
Devil's Hopyard—wild ravine; near East Haddam (31).
Fort Shantok—historic spot near Montville, associated with Mohegan Indians; Shantok Burying Ground (32).
Gillette Castle—secret panels, hidden rooms in house (1919) of actor William Gillette; nr. East Haddam (34).
Hammonasset Beach—large beach near Madison (44).
Housatonic Meadows—trout fishing on Housatonic R. (8).
Hurd—brook in hemlock gorge near Middle Haddam: dinosaur footprints on sandstone (29).
Indian Well—outing area; near Shelton (38).
Kent Falls—on Appalachian Trail near Cornwall (13).
Lake Waramaug—near Kent; wooded surroundings (18).
Macedonia Brook—largest state park; near Kent (12).
Mashamoquet Brook—near Pomfret; includes Wolf Den where Israel Putnam supposedly captured a wolf (11).
Rocky Neck—beach on L. I. Sound near Niantic (46).
Sherwood Island—popular bathing beach at Westport (52).
Sleeping Giant—5 hills of Mount Carmel Range in shape of sleeping giant; near Mount Carmel (35).
Squantz Pond—bathing, picnicking near Danbury (30).
West Peak—1,007-foot trap rock; near Meriden (24).
Wharton Brook—on Quinnipiac Trail nr. New Haven (35).

*Numbers in parentheses are keyed to map.
†There are 57 state park areas; 19 are given here.

Connecticut Fact Summary

LARGEST CITIES (1950 census)

Hartford (177 397) state capital insurance and manufacturing center transportation hub

New Haven (164 443) once joint capital with Hartford Yale U fire arms toys tools

Bridgeport (158 709) industrial city manufacturing munitions aircraft electrical machinery and hardware

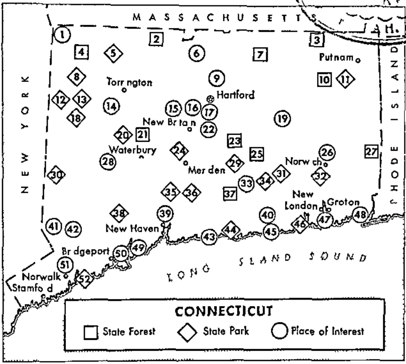
Waterbury (104 477) center of brass and watch making industries

Stamford (74 293) residential city makes locks and hardware

New Britain (73 726) hardware metal products machine tools electrical appliances

Norwalk (49 460) makes hats pumps hardware electrical goods

West Hartford (44 402) residential suburb of Hartford Noah Webster s birthplace



STATE FORESTS*†

Cockaponset (Middlesex County) 14 544 acres (37)
Housatonic (Litchfield County) 9 142 acres (4)
Mattatuck (Litchfield County)—4 358 acres (21)
Meshomasic (Middlesex County)—7 300 acres (23)
Natchaug (Windham County) 9 355 acres (10)
Nipmuck (Tolland County)—8 384 acres (3)
Pachaug (New London County)—21 861 acres (27)
Salmon River (New London County)—5 988 acres (25)
Shenipsit (Tolland County)—6 019 acres (7)
Tunxis (Hartford County)—8 071 acres (2)

PLACES OF INTEREST*

Bear Mt —A high point in state (2 355 *ft*) *skiing (1)*
Bridgeport—P T Barnum s home includes Barnum Institute of Science and History Seaside Park a gift to the city from the showman (*see* Bridgeport) (50)
Elizabeth Park—about 500 varieties of roses in natural setting Rose Festival each June W Hartford (16)
Essex—*shipyard where first warship of* U S Navy *Oliver Cromwell* was built in 1775 (40)
Farmington Museum—Farmington 17th century saltbox house one of oldest in state china silver (15)
Glebe House—restored 18th-century house with secret passage leading to hill tunnel in Woodbury (28)
Groton—U S *Navy submarine* base first atomic-powered submarine launched 1954 Fort Griswold where about 800 British under Benedict Arnold massacred most of garrison of 150 colonial militiamen 1781 (47)
Guilford—old village with varied collection of colonial homes Whitfield House stone house built 1640 (43)
Hartford—Charter Oak Memorial Mark Twain House old and new capitols (*see* Hartford) (17)
Israel Putnam Memorial Camp Ground—Redding where state troops spent the bitter winter of 1778–79 (42)
Litchfield first law school in U S (1784) many fine old homes including Tapping Reeve house (14)
Merritt and Wilbur Cross Parkways—expressways New York to Milford and Milford almost to Mass (49)
Miantonomo Memorial—honors Narragansett Indian chief captured *here and executed* near *Norwich* (26)
Mystic—early shipbuilding center and seaport Mystic Art Gallery Marine Historical Museum west of (48)
Nathan Hale Schoolhouse—East Haddam country school where the famous colonial patriot once taught (33)
Newgate Prison—underground dungeons copper mines *used during Revolutionary War near E Granby (6)*
New Haven—Yale University East Rock Park many places of historic interest (*see* New Haven) (39)
New London—whaling city of 1800 s Whaling Museum Old Town Mill (first built in 1660) Connecticut Coast Guard Academy New London Lighthouse first in state (1760) Ocean Beach Park (47)
Old Saybrook—original site of Yale University historic houses taverns churches (45)
Old Stone Lighthouse—now a museum Stonington (48)
Ridgefield—site of Revolutionary War battle in 1777 (41)
Sachem s Head—rocky promontory on Long Island Sound near Guilford battle of Pequot War 1637 (43)
Webb House—colonial house in Wethersfield where in 1781 Washington planned Yorktown campaign (22)
Wheelock House—at Columbia seat of Eleazar Wheelock s early Indian School which moved to Hanover N H and became Dartmouth College (19)
Windsor—examples of 17th century architecture (9)
Yankee Doodle House (Site of)—remains of Norwalk home of Colonel Fitch whose troops according to tradition inspired the song Yankee Doodle (51)

*Numbers in parentheses are keyed to map
†There are 26 state forests the ten largest are listed.

Connecticut Fact Summary

THE PEOPLE BUILD THEIR STATE

1614—Adrian Block, a Dutchman, explores Connecticut coast and lower Connecticut River.

1631—Earl of Warwick grants patent to Plymouth Company to colonize Connecticut region.

1632—Edward Winslow of Plymouth Colony explores the region.

1633—Jacob van Curler buys from Indians land at site of present Hartford; with other Dutch settlers builds Fort Good Hope; fort abandoned, 1653. Lieut. William Holmes of Plymouth Colony establishes post on site of present Windsor.

1635—English from Massachusetts Bay Colony migrate to Connecticut, settling at the River Towns of Windsor, Hartford, and Wethersfield. John Winthrop, Jr., builds fort at Saybrook.

1636—General court of settlers' provisional government holds its first meeting. First church opens at Hartford. Reprisals taken against Indians after killing of John Oldham off Block Island: Pequot Indians in turn attack settlers through winter of 1636–37; in May 1637, settlers join in war against Pequots, finally defeating them, July 13.

1637—English make peace treaty with Mohegan and Narragansett Indians.

1638—Theophilus Eaton and Rev. John Davenport establish settlement at Quinnipiac (New Haven) Fundamental Orders to govern River Towns drafted.

1639—Fundamental Orders adopted by Wethersfield, Windsor, and Hartford, January 14, making an assembly, the General Court, supreme authority in Colony. Document is often regarded as the first written constitution in history to result in an established government. First assembly meets at Hartford in May. Colony at New Haven establishes a separate civil government in June.

1642—First free public school opens in New Haven.

1643—New Haven Colony includes Milford, Guilford, Stamford, Branford, and Southhold, Long Island.

1644—Saybrook becomes part of Connecticut Colony.

1650—Roger Ludlow compiles a body of laws (Ludlow's Code) for Connecticut.

1659—Property qualifications imposed for suffrage.

1661—Colonists petition king for royal charter.

1662—King Charles II grants royal charter to Connecticut, May 1, combining New Haven Colony with Connecticut Colony; New Haven protests but finally agrees in 1664. Charter defines boundaries as Massachusetts on north, Narragansett Bay on east, Long Island Sound on south, and westward to Pacific. Eastern and southern boundaries occasion long dispute with Rhode Island and New York.

1664—John Colt builds first ship in New London; Connecticut shipyards later become famous.

1665—Hartford made capital of Connecticut Colony.

1666—County governments established in the Colony.

1675—Colonists block attempt by Sir Edmund Andros to land troops at Saybrook to enforce New York's claims on Connecticut. Connecticut colonists join in King Philip's War against the Wampanoags, finally ending conflicts with the Indians.

1687—Sir Edmund Andros, governor of Dominion of New England (formed in 1686 of seven New England colonies), demands surrender of Connecticut charter; document safely hidden in Charter Oak. Connecticut is annexed to Dominion of New England.

1689—Connecticut's protests against annexation succeed: Colony resumes its charter government.

1701—Collegiate School founded at Branford; moves to New Haven, 1716; renamed Yale College, 1718. New Haven is made joint capital with Hartford, assembly meeting alternately in each city.

1708—General Court adopts Saybrook Platform, allowing sects other than the established Congregational church.

1753—Susquehannah Company organized at Windham for purpose of colonizing Wyoming Valley (in present Pennsylvania); first settlement made, 1762

1769—Settlers from Connecticut and previous settlers in Pennsylvania clash in first of "Yankee-Pennamite Wars" over claims to land in Wyoming Valley: dispute settled by adjudication, 1782.

1775—Connecticut colonists join American Revolution after battle of Lexington, organizing six regiments: numerous skirmishes with British in Connecticut until 1781. Danbury, New Haven, Fairfield, New London, Norwalk plundered and burned by British.

1776—Government reorganized as state based on charter of 1662.

1786—Connecticut cedes to U. S. its western lands, except for Western Reserve in present Ohio.

1788—Connecticut is fifth state to ratify U. S. Constitution, January 9. First woolen mill in New England founded at Hartford.

1792—Union Bank of New London and Hartford Bank of Hartford, first banks in state, are established.

1794—Eli Whitney begins manufacture of cotton gins at New Haven factory. First successful cotton mill in state opened at Hilliardsville.

1795—State sells most of Western Reserve lands to Connecticut Land Company for $1,200,000: money used to establish state school fund. Mutual Assurance Company of the City of Norwich incorporated; state begins as insurance center.

1798—Eli Whitney establishes firearms factory at Whitneyville; pioneers in assembly-line technique.

1801—First American cigars made at South Windsor, leads to tobacco growing in Connecticut Valley.

1812—Embargo forces Connecticut to manufacture many products formerly imported; opposes war with England, refusing use of state militia: joins in Hartford Convention of 1814, protesting war.

1818—State adopts new constitution which disestablishes Congregational church as state church.

1844—New York and New Haven Railroad chartered: completed across state, 1848; becomes New York, New Haven and Hartford Railroad, 1872.

1845—State adopts universal manhood suffrage.

1848—Assembly passes act freeing all slaves.

1875—Hartford becomes sole state capital.

1878—World's first commercial telephone exchange established in New Haven.

1880—Boundary dispute with New York finally settled.

1881—Conn. Agricultural College founded at Storrs.

1910—U. S. Coast Guard Academy moves to New London from Arundel Cove, Md.

1917—U. S. Navy builds submarine base at Groton.

1947—State adopts Fair Employment Practices Act.

1950—Assembly refuses to adopt proposed state government reorganization plan.

1951—Home Rule Act permits cities, towns, and boroughs to amend charters without legislative action.

1954—The *Nautilus*, world's first submarine with an atomic engine, launched at Groton.

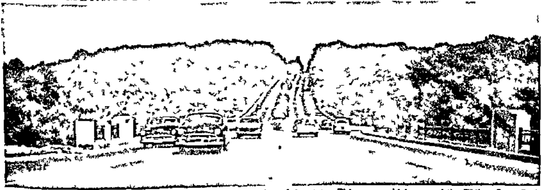
CONNECTICUT

COUNTIES		
Fairfield	504 342	B 3
Hartford	539 661	E 1
Litchfield	98 872	C 1
Middlesex	*67 332*	*E 3*
New Haven	545 784	D 3
New London	144 821	G 2
Tolland	44 709	F 1
Windham	61 759	H 1

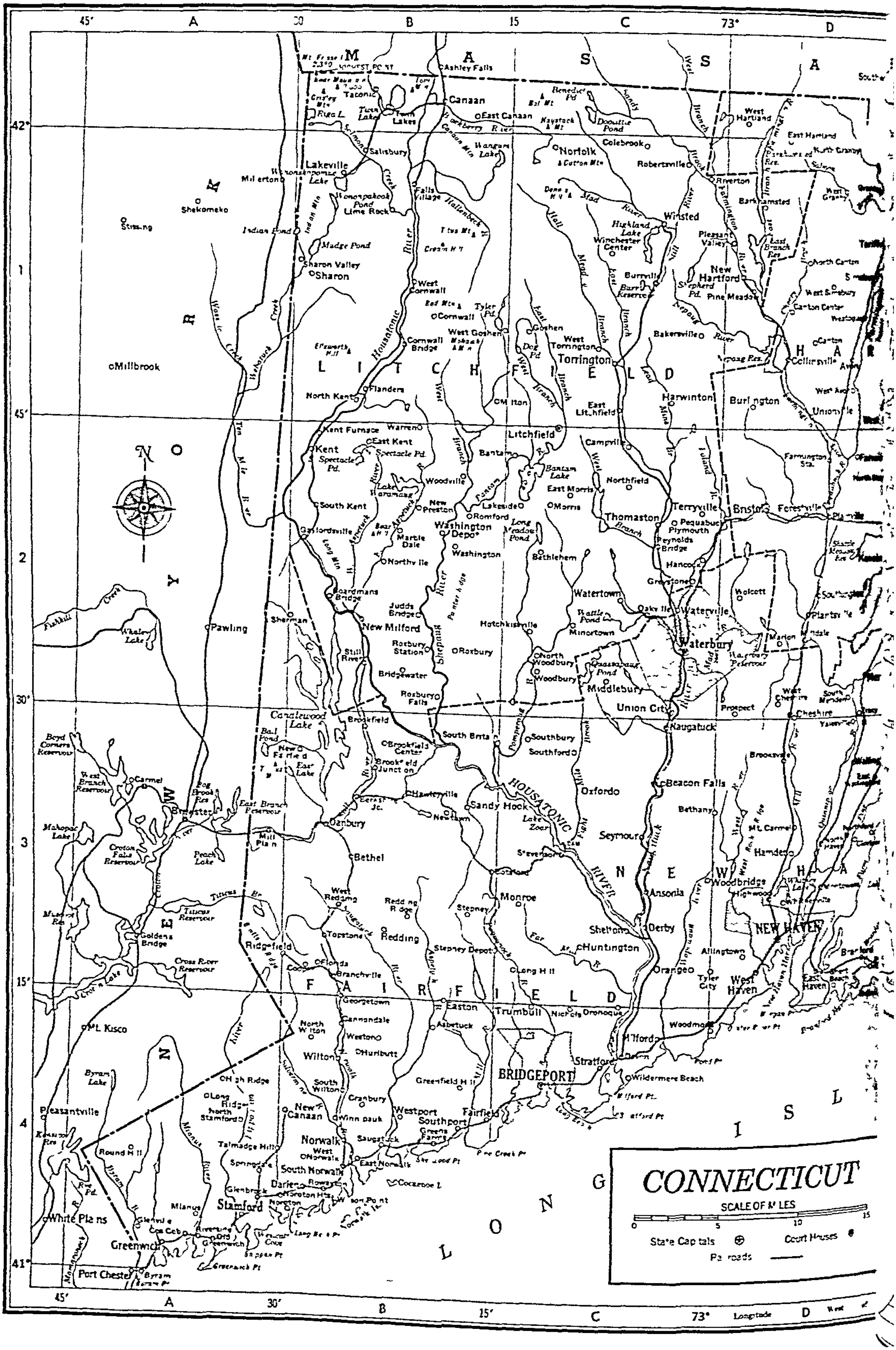
CITIES AND TOWNS		
Abington	450	G 1
Addison	*900*	*E 2*
Allingtown	4 800	D 3
Amston	200	F 2
Andover	†1 034	F 2
Ansonia	18 706	C 3
Arnolds		E 3
Ashford	†845	G 1
Aspetuck		B 4
Atwoodville	35	G 1
Avon	†3 171	D 1
Bakersville		C 1
Ballouville		H 1
Baltic	1 345	G 2
Bantam	940	B 2
Barkhamsted	†946	D 1
Beach Park	500	E 3
Beacon Falls	†2 067	C 3
Beckleys	100	E 2
Berkshire Jct		B 3
Berlin	†7 470	E 2
Bethany	†1 318	C 3
Bethel	†5 104	B 3
Bethlehem	†1 015	C 2
Black Hall		F 3
Black Point Beach Club	100	G 3
Bloomfield	*†5 746*	*E 1*
Boardmans Bridge	75	B 2
Bolton	†1 279	F 1
Botsford		C 3
Branchville	300	B 3
Branford	2 552	D 3
Bridgeport	158 709	C 4
Bridgewater	†639	B 2
Bristol	35 961	D 2
Broad Brook	2 140	E 1
Brookfield	†1 688	B 3
Brookfield Ctr		B 3
Brookfield Jct		B 3
Brooklyn	†2 652	H 1
Brooksvale	500	D 3
Buckingham	350	E 2
Buckland	750	E 1
Burlington	†1 846	D 1
Burnside		E 1
Burrville	250	C 1
Byram	8 000	A 4
Campbell		F 1
Campville		C 2
Canaan	1 189	B 1
Cannondale	300	B 4
Canterbury	†1 321	H 2
Canton	*†3 613*	*D 1*
Canton Ctr	300	D 1
Centerbrook	487	F 3
Central Village	800	H 2
Chaplin	†712	G 1
Cheshire	†6 295	D 2
Chester	†1 920	F 3
Chesterfield	120	G 3
Chestnut Hill		G 2
Clarks Corner	78	G 1
Clarks Falls	200	H 3
Clinton	†4 166	E 3
Clintonville	850	D 3
Cobalt	500	E 2
Colchester	1 522	F 2
Colebrook	*†592*	*C 1*
Collinsville	2 078	D 1
Columbia	†1 327	F 2
Cooper		B 3
Cornwall	†896	B 1
Cornwall Bridge		B 1
Cos Cob	6 800	A 4
Coventry	†4 043	F 1
Coventry (S Coventry)	1 617	F 1
Cranbury	3 000	B 4
Crescent Beach		G 3
Cromwell	†4 286	E 2
Crystal Lake	350	F 1
Danbury	22 067	B 3
Danielson	4 554	H 1
Darien	†11 767	B 4
Dayville (Killingly)	1 105	H 1
Deep River	†2 570	F 3
Derby	10 259	C 3
Devon		C 4
Durham	†1 804	E 3
Durham Ctr		E 3
Eagleville	265	F 1
E Berlin	1 000	E 2
E Brooklyn	1 062	H 1
E Canaan	*800*	*B 1*
E Glastonbury	450	E 2
E Granby	†1 327	E 1
E Haddam	†2 554	F 3
E Hampton	†4 000	E 2
E Hartford	†29 933	E 1
E Hartland	400	D 1
E Haven	†12 212	D 3
E Kent		*B 2*
E Killingly	800	H 1
E Litchfield	60	C 1
E Lyme	†3 870	G 3
E Morris		C 2
E Norwalk	5 000	B 4
E River	450	E 3
E Thompson	200	H 1
E Wallingford		D 3
E Willington	50	F 1
E Windsor	†4 859	E 1
E Windsor Hill	671	E 1
E Woodstock	25	H 1
Eastford	†598	G 1
Easton	†2 165	B 4
Ellington	*†3 099*	*F 1*
Elliott		G 1
Elmwood	6 000	D 2
Enfield	†15 464	E 1
Essex	†3 491	F 3
Fabyan	425	H 1
Fairfield	†30 489	B 4
Falls Village	640	B 1
Farmington	†7 026	D 2
Farmington *Station*		*D 2*
Fenwick	16	F 3
Fitchville	300	G 2
Flanders		B 1
Florida		B 3
Forestville	6 000	D 2
Franklin	†727	G 2
Gales Ferry	300	G 3
Gardner Lake		G 2
Gaylordsville	200	B 2
Georgetown		B 4
Gildersleeve		E 2
Gilead	70	F 2
Gilman	400	G 2
Glasgo		H 2
Glastonbury	*†8 818*	*E 2*
Glenbrook		A 4
Glenville	976	A 4
Goodyear	1 000	H 1
Goshen	†940	C 1
Granby	†2 693	D 1
Greenfield Hill		B 4
Greens Farms	500	B 4
Greenville		G 2
Greenwich	†40 835	A 4
Greystone	150	C 2
Griffins		*E 1*
Grosvenor Dale	800	H 1
Groton	7 036	G 3
Groton Long Pt		G 3
Grove Beach		E 3
Guilford	†5 092	E 3
Gurleyville	120	G 1
Haddam	†2 636	E 3
Haddam Neck	50	E 2
Hadlyme	300	F 3
Hallville		G 2
Hamburg		F 3
Hamden	†29 715	D 3
Hampton	†672	G 1
Hancock	25	C 2
Hanover	*300*	*G 2*
HARTFORD	177 397	E 1
Harwinton	†1 858	C 1
Hawleyville		B 3
Hazardville	1 272	E 1
Hebron	†1 320	F 2
Higganum		E 2
High Ridge		A 4
Highland Park		F 1
Highwood		D 3
Hockanum		*E 2*
Hop River		F 2
Hotchkissville	300	C 2
Huntington		C 3
Hurlbutt		B 4
Ivoryton	885	F 3
Jewett City	3 702	H 2
Jordan Village (Waterford)		G 3
Judds Bridge	30	B 2
Kensington	4 700	D 2
Kent	*†1 392*	*B 2*
Kent Furnace		B 2
Killingly (Dayville)	1 105	H 1
Killingworth	†677	E 3
Lakeside		*B 2*
Lakeville		B 1
Lebanon	†1 654	G 2
Lebanon Station		G 2
Ledyard	†1 749	G 3
Leetes Island		E 3
Lime Rock	186	B 1
Litchfield	1 174	C 2
Long Hill		C 3
Long Ridge		A 4
Lords Pt	400	H 3
Lyman Viaduct	*4*	*F 2*
Lyme	†857	F 3
Madison	†3 078	E 3
Manchester	†34 116	E 1
Manchester Green		E 1
Mansfield	†10 008	F 1
Mansfield Ctr	600	G 1
Mansfield Depot		F 1
Marble Dale	150	B 2
Marion	366	D 2
Marlborough	†901	F 2
Massapeag		G 3
Mechanicsville		H 1
Melrose		E 1
Meriden	*44 088*	*D 2*
Merrow	125	F 1
Mianus		A 4
Middle Haddam		E 2
Middlebury	†3 318	C 2
Middlefield	†1 983	E 2
Middletown	29 711	E 2
Milford	†26 870	C 4
Mill Plain	125	A 3
Milldale	*1 200*	*D 2*
Millstone		G 3
Milton	200	C 1
Minortown	100	C 2
Mohegan		G 3
Monroe	†2 892	C 3
Montowese		D 3
Montville	†4 766	G 3
Moodus	1 400	F 2
Moosup	2 909	H 2
Morris	†799	C 2
Mt Carmel		D 3

†Population of township

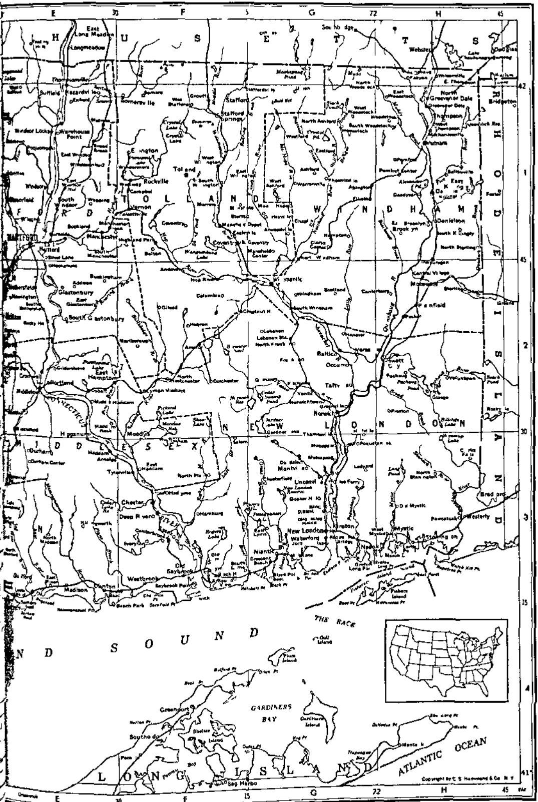
MERRITT PARKWAY—GATEWAY TO NEW ENGLAND



The magnificent Merritt Parkway climbs the rolling tree-covered hills of Connecticut near Stamford It is called the Main Street of the state This express highway and the Wilbur Cross Parkway extend from the New York line almost to Massachusetts



CONNECTICUT
SCALE OF MILES
0
5
10
15
State Capitals
Court Houses
Railroads
45'
A
30'
B
15
C
73°
D
42°
41°
Longitude
West
Ashley Falls
Canaan
East Canaan
Taconic
Twin Lakes
Salisbury
Lakeville
Millerton
Shekomeko
Indian Pond
Madge Pond
Sharon Valley
Sharon
Lime Rock
Falls Village
West Cornwall
Cornwall
Cornwall Bridge
Norfolk
Colebrook
Robertsville
Riverton
Winsted
Highland Lake
Winchester Center
Burrville
West Hartland
East Hartland
Barkhamsted
Pleasant Valley
New Hartford
Pine Meadow
North Canton
West Simsbury
Canton Center
Bakersville
Collinsville
Avon
West Goshen
Goshen
West Torrington
Torrington
Harwinton
Burlington
Unionville
Millbrook
Flanders
North Kent
Milton
East Litchfield
Kent Furnace
Warren
Kent
East Kent
Spectacle Pd.
Litchfield
Bantam
Bantam Lake
Campville
Northfield
East Morris
Morris
Woodville
South Kent
New Preston
Lakeside
Romford
Thomaston
Terryville
Pequabuck
Plymouth
Bristol
Forestville
Plainville
Farmington Sta.
Gaylordsville
Marble Dale
Washington Depot
Washington
Bethlehem
Reynolds Bridge
Hancock
Northville
Boardmans Bridge
Judds Bridge
Watertown
Greystone
Wolcott
Southington
Plantsville
Pawling
Sherman
New Milford
Hotchkissville
Oakville
Waterville
Waterbury
Marion
Whaley Lake
Fishkill
Roxbury Station
Roxbury
Minortown
Still River
Bridgewater
North Woodbury
Woodbury
Middlebury
Roxbury Falls
Union City
Prospect
West Cheshire
Cheshire
Candlewood Lake
Brookfield
Brookfield Center
Brookfield Junction
South Britain
Southbury
Southford
Naugatuck
Boyd Corners Reservoir
West Branch Reservoir
Carmel
Brewster
East Branch Reservoir
Hawleyville
Sandy Hook
HOUSATONIC
Lake Zoar
Oxford
Beacon Falls
Bethany
Mahopac Lake
Croton Falls Reservoir
Danbury
Newtown
Mill Plain
Peach Lake
Bethel
Stevenson
Seymour
Mt. Carmel
Hamden
West Redding
Redding Ridge
Redding
Stepney
Monroe
Ansonia
Woodbridge
Titicus Reservoir
Goldens Bridge
Topstone
Ridgefield
Stepney Depot
Huntington
Shelton
Derby
NEW HAVEN
Cross River Reservoir
Florida
Branchville
Long Hill
Orange
Allingtown
Tyler City
West Haven
East Haven
Branford
Georgetown
Easton
Trumbull
Nichols
Oronoque
FAIRFIELD
Cannondale
Aspetuck
Mt. Kisco
North Wilton
Weston
Hurlbutt
Milford
Wilton
Woodmont
Stratford
Wildermere Beach
Byram Lake
South Wilton
Greenfield Hill
BRIDGEPORT
High Ridge
Long Ridge
North Stamford
New Canaan
Cranbury
Westport
Southport
Fairfield
Pleasantville
Winnipauk
Kensico Res.
Round Hill
Talmadge Hill
Norwalk
West Norwalk
Saugatuck
Greens Farms
Pine Creek Pt.
Springdale
South Norwalk
East Norwalk
Darien
Rowayton
Glenbrook
Noroton Hts.
Stamford
Noroton
Mianus
Glenville
Cos Cob
Riverside
Old Greenwich
Greenwich
White Plains
Port Chester
Byram
Greenwich Pt.
LONG
ISL



E
30
F
G
72
H
45
42
41
East Long Meadow
Longmeadow
Webster
Thompsonville
Suffield
Enfield
Somers
Stafford
Stafford Springs
North Grosvenor Dale
Thompson
Putnam
Windsor Locks
Warehouse Point
Rockville
Vernon
Tolland
T O L L A N D
W I N D H A M
Danielson
Hartford
Manchester
Bolton
Coventry
Willimantic
Glastonbury
South Glastonbury
Columbia
Marlborough
Hebron
Colchester
Lebanon
Baltic
Plainfield
Jewett City
East Hampton
Portland
Middletown
Moodus
Norwich
N E W   L O N D O N
M I D D L E S E X
Higganum
Haddam
Deep River
Chester
Essex
Uncasville
New London
Groton
Waterford
Mystic
Westerly
Stonington
Niantic
Old Saybrook
Westbrook
Clinton
Madison
Saybrook Point
THE RACE
Fishers Island
N D   S O U N D
GARDINERS BAY
Greenport
Southold
Shelter Island
Sag Harbor
L O N G   I S L A N D
ATLANTIC OCEAN
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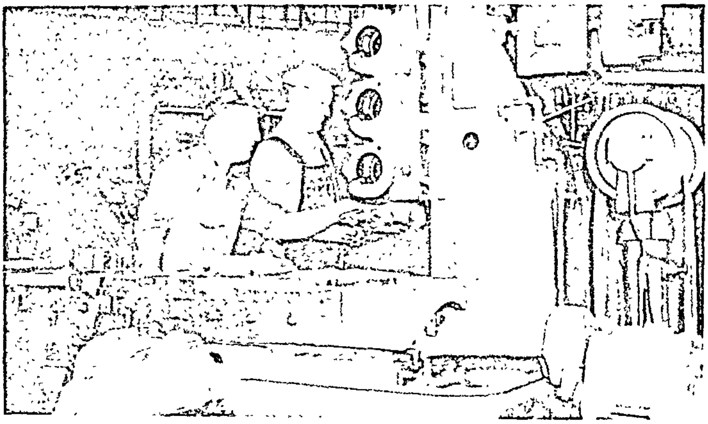
A TRADITION OF SKILLFUL AND VARIED MANUFACTURING



The manufacturing of the state is built around the metal trades. Important is the production of machines that make machines (left).

Since the days of the American Revolution, Connecticut has been known as the Arsenal of the Nation for its firearms industry (right).

CONNECTICUT—*Continued*

Mt. Hope	50	G 1
Mystic	2,266	H 3
Naugatuck	17,455	C 3
New Britain	73,726	E 2
New Canaan	†8,001	B 4
New Fairfield	†1,236	B 3
New Hartford	†2,395	C 1
New Haven	164,443	D 3
New London	30,551	G 3
New Milford	†5,799	B 2
New Preston	500	B 2
Newington	†9,110	E 2
Newtown	782	B 3
Niantic	1,746	G 3
Nichols	1,171	C 4
Noank	1,149	G 3
Norfolk	†1,572	C 1
Noroton	3,000	B 4
Noroton Hts.	3,918	B 4
N. Ashford		G 1
N. Branford	†2,017	E 3
N. Canton	250	D 1
N. Franklin	735	G 2
N. Granby	650	D 1
N. Grosvenor Dale	2,232	H 1
N. Guilford	1,000	E 3
N. Haven	†9,444	D 3
N. Kent		B 1
N. Madison		E 3
N. Newington		D 2
N. Plain		F 3
N. Stamford		A 4
N. Sterling		H 1
N. Stonington	†1,367	H 3
N. Westchester	100	F 2
N. Wilton		B 4
N. Windham	300	G 1
N. Woodbury		C 2
N. Woodstock		G 1
Northfield		C 2
Northford	800	D 3
Northville	150	B 2
Norwalk	49,460	B 4
Norwich	23,429	G 2
Norwichtown	2,916	G 2
Oakdale	150	G 3
Oakville	5,100	C 2
Occum		G 2
Old Greenwich	5,348	A 4
Old Lyme	†2,141	F 3
Old Mystic	600	H 3
Old Saybrook	†2,499	F 3
Oneco	450	H 2
Orange	†3,032	C 3
Orcutts	150	F 1
Oronoque	650	C 4
Oxford	†2,037	C 3
Pachaug	75	H 2
Packer	63	H 2
Pawcatuck	5,269	H 3
Pequabuck	600	C 2
Phoenixville		G 1
Pine Meadow	425	D 1
Pine Orchard	1,500	D 3
Plainfield	†8,071	H 2
Plainville	†9,994	D 2
Plantsville	1,536	D 2
Pleasant Valley	325	C 1
Plymouth	†6,771	C 2
Pomfret	†2,018	H 1
Pomfret Ctr.	675	H 1
Poquetanuck		G 3
Poquonock	1,200	E 1
Poquonock Bridge	4,050	G 3
Portland	†5,186	E 2
Preston	†1,775	H 2
Prospect	†1,896	D 2
Putnam	8,181	H 1
Quaker Hill	1,260	G 3
Quinebaug	400	H 1
Rainbow		E 1
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Redding Ridge		B 3
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Ridgefield	†4,356	A 3
Riverside	2,000	A 4
Riverton	220	D 1
Robertsville	130	C 1
Rockfall	2,000	E 2
Rockville	8,016	F 1
Rocky Hill	†5,108	E 2
Romford	30	B 2
Round Hill	600	A 4
Rowayton	3,200	B 4
Roxbury	†740	B 2
Roxbury Falls		B 2
Roxbury Sta.		B 2
Sachem Head		E 3
Salem	†618	F 3
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Sandy Hook	1,600	B 3
Saugatuck	1,500	B 4
Saybrook Pt.	250	F 3
Scitico	125	E 1
Scotland	†513	G 2
Seymour	†7,832	C 3
Sharon	†1,889	B 1
Sharon Valley	174	B 1
Shelton	12,694	C 3
Sherman	†549	B 2
Short Beach		D 3
Silver Lane		E 1
Simsbury	†4,822	D 1
Somers	†2,631	F 1
Somersville	750	F 1
Sound View	100	F 3
S. Britain	400	B 3
S. Coventry	1,617	F 1
S. Glastonbury		E 2
S. Kent	108	B 2
S. Killingly	250	H 1
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S. Windsor	†4,066	E 1
S. Woodstock		G 1
Southbury	†3,828	C 3
Southford		C 3
Southington	†13,061	D 2
Southport	3,000	B 4
Springdale	5,280	A 4
Stafford	†6,471	F 1
Stafford Springs	3,396	F 1
Staffordville	1,000	G 1
Stamford	74,293	A 4
Stepney		B 3
Stepney Depot	3,000	B 3
Sterling	†1,298	H 2
Stevenson	200	C 3
Still River	200	B 2
Stonington	1,739	H 3
Stony Creek	1,800	E 3
Storrs		F 1
Stratford	†33,428	C 4
Suffield	†4,895	E 1
Taconic	150	B 1
Taftville	3,598	G 2
Talcottville	568	F 1
Talmadge Hill		A 4
Tariffville	800	D 1
Terryville	6,500	C 2
Thamesville	5,518	G 2
Thomaston	†4,896	C 2
Thompson	†5,585	H 1
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Tolland	†1,659	F 1
Topstone		B 3
Torrington	27,820	C 1
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Trumbull	†8,641	C 4
Twin Lakes		B 1
Tyler City		D 3
Tylerville		F 3
Uncasville		G 3
Union	†261	G 1
Union City	5,000	C 2
Unionville	2,197	D 1
Vernon	†10,115	F 1
Versailles		G 2
Voluntown	†825	H 2
Wallingford	11,994	D 3
Wapping	1,000	E 1
Warehouse Pt.	1,283	E 1
Warren	†437	B 2
Warrenville		G 1
Washington	†2,227	B 2
Washington Depot	700	B 2
Waterbury	104,477	C 2
Waterford (Jordan Village)		G 3
Watertown	†10,699	C 2
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W. Goshen		B 1
W. Granby		D 1
W. Hartford	†44,402	D 1
W. Hartland	196	D 1
W. Haven	†32,010	D 3
W. Mystic	2,362	H 3
W. Norwalk	724	B 4
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W. Simsbury	300	D 1
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W. Thompson		H 1
W. Torrington	240	C 1
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Westport	†11,667	B 4
Westway		F 1
Wethersfield	†12,533	E 2
Whitneyville		D 3
Wildermere Beach		C 4
Willimantic	13,586	G 2
Wilson	3,500	E 1
Wilson Pt.	200	B 4
Wilsonville	385	H 1
Wilton	†4,558	B 4
Winchester Ctr.		C 1
Windermere	95	F 1
Windham	†15,884	G 2
Windsor	†11,833	E 1
Windsor Locks	†5,221	E 1
Windsorville		E 1
Winnipauk	3,600	B 4
Winsted	8,781	C 1
Wolcott	†3,553	D 2
Woodbridge	†2,822	D 3
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†Population of township

chickens potatoes cattle corn apples and truck crops The uplands are best adapted to the raising of dairy cattle and of orchards and vineyards—apples peaches pears and grapes The lowland farms produce tobacco particularly high-quality leaf for cigar wrappers These farms also yield garden vegetables which are marketed in nearby towns and cities

Connecticut has important fisheries Oysters flounders and lobsters are the most valuable sea foods Other important fishery products are scup or porgy shad butterfish cod and sea herring

Minerals and Forests

Early manufacturing in Connecticut depended upon its mineral resources In 1705 copper deposits were discovered near present Granby in the north central part of the state Here the Old Granby copper mine yielded the ore from which the first copper coins minted in America were made The mine was abandoned after it became unprofitable Later it was used as a prison during the Revolutionary War and as a state prison until 1827

In the northwestern part of the state near Salisbury there were deposits of high-quality iron ore Farmers and small factories used ore to make hand wrought nails in colonial times During the Revolutionary War the ore was used in manufacturing cables anchors kettles and cannon The enterprise died in the 19th century through depletion and competition from the Pennsylvania industry

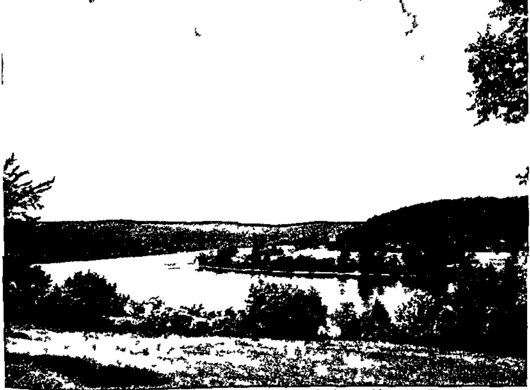
Connecticut still mines some brick clay building stone feldspar limestone for lime quartz peat and sand and gravel Because the state lacks such *important minerals as coal and petroleum and has only small deposits of metallic ores the total value of its* mineral production is relatively small

Altho gh large tracts have been cleared the state still has some valuable forest land On this land are such trees as hickory oak, butternut beech birch maple ash and elm Nearly all the once common chestnut trees have been killed by the chestnut blight caused by a parasitic fungus on the bark Since 1890 the state has been producing much less than one per cent yearly of the nation s lumber

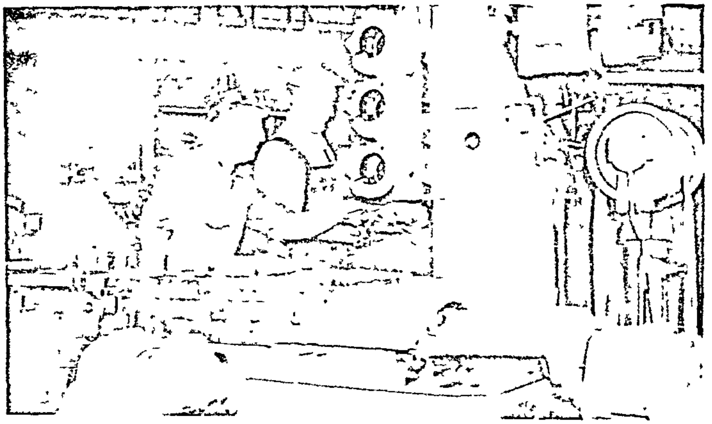
A Year Round Playground

Connecticut s a popular recreation state for its own residents and also for many out-of staters The reason for its vacation time popularity is the great variety of its attractions They are all within easy reach in this small state with fine highways For the tourist there is a range of sights from busy

PICTURESQUE CONNECTICUT RIVER VALLEY



The broad Connecticut River winds its way among pleasant forest clad hills near Haddam. In this beautiful and fertile valley are fine farms and busy cities The river is the largest in New England and divides the state from north to south



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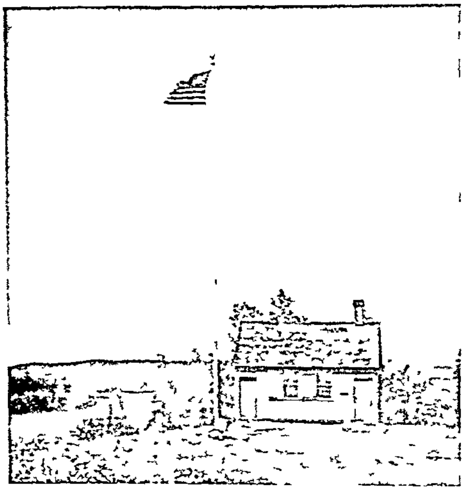
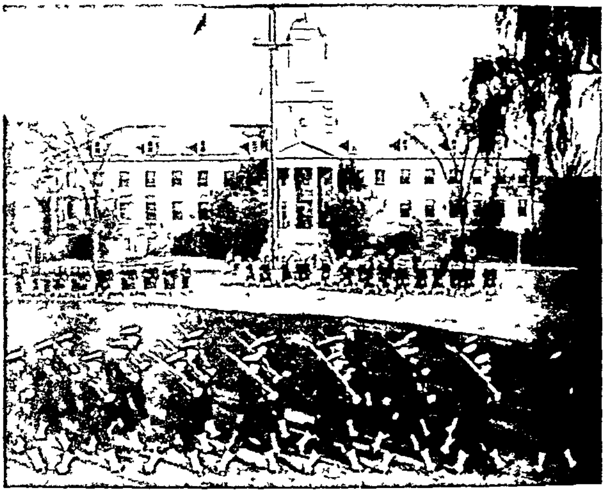
A LONG AND NOTABLE HISTORY IN EDUCATION



On a rise of ground at East Haddam overlooking the Connecticut River is the first school in which Nathan Hale taught, 1773-74. Hale was born at Coventry, Conn , and studied at Yale College.



At New London is the United States Coast Guard Academy, the "Annapolis" of the Coast Guard service. Here future officers snappily execute their platoon drills in front of Hamilton Hall.

interesting industrial centers to peaceful colonial villages, little changed from their early days.

At Hartford is the Old State House, the work of the noted colonial architect Charles Bulfinch. Gillette Castle at East Haddam was the unique home of the famous actor William Gillette. Here too is the schoolhouse where the patriot Nathan Hale taught. At New London is the United States Coast Guard Academy. The Israel Putnam Memorial Camp Ground near Danbury is a Revolutionary War battlefield. The complete list of places of interest is long.

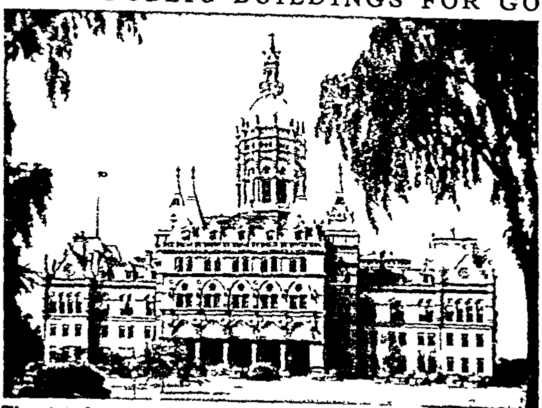
The history-minded are transported back centuries in time as they view the many well-preserved colonial homes in the state. Among the more notable are the Old Whitfield House at Guilford, the Webb House in Wethersfield, and the Glebe House at Woodbury. At the Marine Historical Museum at Mystic, sea-and-sail enthusiasts find relics of the days when whaling was a leading occupation of New Englanders.

There is much of interest for sportsmen and outdoor lovers in all seasons. The scenic forested hills and valleys invite hiking and horseback riding. On the many streams, inland lakes, and Long Island Sound are varied fresh- and salt-water sports in summer. They range from swimming and fishing to yachting. Splendid beaches stretch for miles and there are many resorts. In winter the hills and waters attract skiers and skaters. Thousands of acres have been set aside for the public in state parks and state forests. (*See also* Connecticut Fact Summary for state parks, state forests, and other places of interest.)

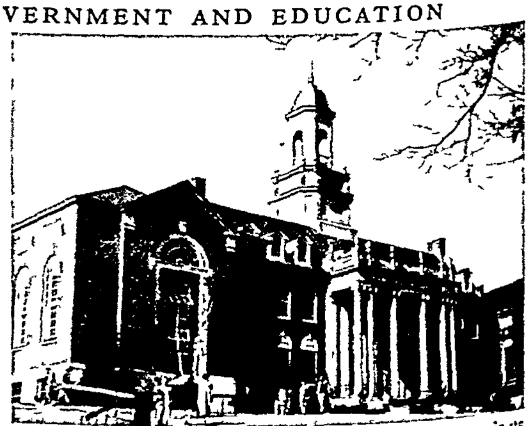
The People of Connecticut

The first settlers who organized the Connecticut colony were from Massachusetts and therefore were of English origin. They cleared the land, built homes, and set up farms. In the late 1700's and early 1800's they erected the first small mills and factories. After the potato famines of 1846–47 in Ireland, many

PUBLIC BUILDINGS FOR GOVERNMENT AND EDUCATION



The state laws are made in this impressive building. The Capitol stands on a landscaped knoll in Capitol Park in Hartford.



At Storrs is the University of Connecticut. Shown above is its Wilbur L. Cross Library, named for a governor of the state.

CONNECTICUT S OLDEST AND MOST FAMOUS UNIVERSITY

These halls are part of Yale University chartered in 1701 the third oldest univers ty in the nat on This row of buildings is half of one s de of a quadrangle enclosing the lawn shown Other groups of the university s buildings are scattered throughout New Haven Through the Phe ps Gateway in the tower is the Green the old publ c ground around which the city grew

Irish came to Connecticut where they worked as mill hands or as farmers In the late 1800 s many German immigrants arrived French and Engl sh Canadians came in large numbers After 1900 many Scandinavians Italians and Poles settled in the state

Connecticut s population thus changed from one al most entirely of British ancestry to one represent ng almost every European nation and Canada People of foreign birth made up an increasing part of its popu lation until 1920 when the trend began to decline

In the 1630 s nearly all Connecticut s settlers were of the Puritan faith Today the largest denominations in the state are Roman Catholic Jewish Congrega tionalist and Protestant Episcopal

Early Fostering of Education

Soon after the founding of the Connecticut and New Haven colonies the settlers organized public schools s milar to the English grammar schools The Connecticut code of 1650 required all parents to educate their children It also provided that every township with 50 householders had to have a teacher supported by the people of the community

In 1672 the general court the ch ef governmental body gave each county 600 acres of land for school purposes In 1795 the general assembly gave the proceeds from the sale of western lands to educat on

At the present time Connecticut has fine systems of public and parochial education The public system enrolls about 80 per cent of all children attending elementary and secondary schools in the state

Within the state there are several well known insti tutions of higher education These include Yale University at New Haven (founded in 1701) the Univer sity of Connecticut at Storrs Wesleyan University at Middletown and four state teachers colleges

Connecticut s History

In 1633 a Dutch party from New Netherland founded the first settlement along the Connecticut River at a place which later became Hartford The same year John Oldham of Massachusetts explored the river val ley and brought back an encouraging report In 1635 settlers from three Massachusetts towns established Wethersfield Windsor and Hartford In 1636 the Rev Thomas Hooker and Rev Samuel Stone or ganized a Massachusetts party of about a hundred men women and children This party made its way south along the Connecticut River to the almost abandoned towns of the earlier Dutch colonists

The settlers bought their land from friendly Ind an chiefs From these chiefs they received a piece of turf and a twig in token of the transfer of the land and its products The new and tiny settlements how ever were threatened by enemy tribes In 1637 the Pequots went on the warpath The settlers army surprised their fort at night set fire to it and wiped out the tribe thus ending attacks by these Indians.

In 1639 the colonists found they were outside the chartered jurisdiction of Massachusetts Therefore they formed a set of laws entitled the Fundamental Orders of Connect cut This document is often called the first written constitution of history The preamble proclaimed that the people not the English crown were the foundation of authority The 11 orders provided for a general assembly of deput es and for the election of a governor and magistrates They set forth laws for elections courts powers of officials and taxes They omitted however a religious test for citizenship No citizen had to be a church member as required in Massachusetts

In 1662 John Winthrop Jr then governor succeeded in obtaining a royal charter from Charles II This charter establ shed Connecticut as an independ ent colony under its own const tution It also defined the colony s boundaries as Narragansett Bay on the east Massachusetts on the north Long Island Sound on the south and the South Sea (Pacific

CONNECTICUT'S FAMOUS CHARTER OAK

When the English governor came to revoke the charter of the state in 1687, the document was said to have been hidden in this tree in Hartford. The Charter Oak was blown down in 1856.

Ocean) on the west. These boundaries included New Haven, which was absorbed much against its will. In 1665 Hartford became the capital. It shared this honor with New Haven from 1701 to 1875, when Hartford became the sole capital of the state.

Defense of the Charter

For years, Connecticut engaged in disputes over rights granted in its 1662 charter. When Edmund Andros was appointed governor of the New England colonies he was ordered to replace their charters with new ones more favorable to the English crown.

For this purpose Governor Andros came to Hartford Oct. 31, 1687. The story is that one night he and Governor Treat were discussing the surrender of the charter. While doing so, the candles were put out and the document was removed from the table where it lay. It was said to have been hidden in a hollow oak tree which later became famous as the Charter Oak. Although Andros failed to seize the charter, he dissolved the Connecticut government.

After the English Revolution of 1688, Connecticut's charter was again recognized as valid. When the colonists declared their independence in 1776, the 1662 charter became substantially the state constitution. It was replaced in 1818 by a new constitution, under which the state is still governed.

Since early colonial days, Connecticut has had a town system of government. According to its 1818 constitution, each town in existence before that year has two representatives in the lower house of the general assembly. A town incorporated later than that year has representation depending on population.

A Boundary Error

The northern boundary of Connecticut has a small rectangular indentation where territory belonging to Massachusetts breaks the straight line. This irregularity was caused by two surveyors who lived more than 300 years ago.

In 1642 there was a dispute over whether Springfield was in Connecticut or in Massachusetts. The latter colony sent out the surveyors Woodward and Saffery to fix the southern boundary. They began by setting a point on this boundary in the extreme east.

GUILFORD RETAINS THE CHARM OF EARLY NEW ENGLAND

Here is stately Congregational Church framed by the elms on the broad village Green in Guilford. The church was built in 1829 in classical Greek Revival style. Many authentic old homes still stand in this quaint village of the early colonial period.

They then took a boat around Cape Cod and up the Connecticut River They found a place which they believed was the same latitude as the eastern point they had previously located Actually it was eight miles too far south Connecticut protested the line and a long dispute followed Connecticut finally recovered all but this little rectangle, and Massachusetts did not finally abandon the old line until 1826

Under the charter of 1662, Connecticut was to extend westward to the Pacific Ocean As a result Connecticut claimed a large part of the present state of Pennsylvania and a vast strip of land farther west For years Connecticut actually governed the Wyoming Valley of Pennsylvania, where an Indian massacre of whites occurred July 3, 1778

After the Revolutionary War, Connecticut agreed to give up all land west of its present boundary in exchange for a reserve tract in what is now northeastern Ohio This tract, estimated at 3,500 000 acres, became known as the Western Reserve About 500 000 acres were sold to pay benefits to persons whose homes the British had destroyed Proceeds from the sale of the remainder went to the school fund

Connecticut in American Wars

Connecticut suffered little in comparison with the other colonies in the early colonial wars and in the Revolution Troops were freely furnished to the Continental cause, however and Connecticut played an active part Jonathan Trumbull governor of the colony at the outbreak of the Revolution was the only governor in the colonies who was not asked to resign, and he became a close friend of Washington

The little commonwealth as a commercial state did not welcome the War of 1812 but it gave men and supplies liberally William A Buckingham governor at the outbreak of the Civil War established a record for promptness and zeal in that conflict Connecticut s vast industrial capacity made it a great arsenal of democracy" in the first and second World Wars (*See also* chronology in Connecticut Fact Summary, United States, section "New England')

CONRAD JOSEPH (1857-1924) In a charming home in Poland a little boy of 11 put his finger on the map of Africa one day in 1868 and exclaimed, "When I grow up I shall go there!"

Six years later this lad and his tutor were in Switzerland watching English engineers build the St Gotthard Tunnel His tutor urged him to give up his idea of going to sea and to heed his family's wishes and become a lawyer

Young Teodor Josef Konrad Korzeniowski listened in despair Then one of the English engineers passed by, smiled with "a friendly gleam of big sound shiny teeth," and Josef knew that he would sail the Englishman s sea in spite of all tutors

He went to sea in a French ship at 17 In 1878 he entered the British merchant marine He knew very little English but he learned quickly and soon began to think and to talk more clearly in English than in Polish At the age of 32, while recovering from a fever, he began to write a book

This book, 'Almayer s Folly', was not published until the writer was 38 It was the first flash of the genius with which the Polish sailor, later Joseph Conrad, English sea captain, was to fascinate the world Soon after he left the sea, married and settled in the peaceful English countryside at Kent Here he wrote the tales that bring all the beauty and mystery of the sea and the strangeness of the East to untraveled readers Strength and reality run through his writings The English language sings with a fresh beauty under his foreign pen

Conrad was a moody but kind hearted man He was born in the Ukraine, Dec 3, 1857, and died in England Aug 3, 1924 His father was a Polish revolutionist who died when the boy was only 11

Conrad's best-known books are 'Almayer's Folly', The Nigger of the Narcissus', 'Lord Jim', 'Youth', 'Nostromo' 'The Mirror of the Sea , 'The Secret Agent', Under Western Eyes', 'Chance', 'Victory', and 'The Rover' Typhoon' and 'Falk' are among the most famous of his shorter stories

CONSERVATION—*The* WISE USE *of* NATURAL RESOURCES

CONSERVATION The wise use of natural resources is called conservation Soil water, forests and grasslands wildlife and minerals are natural resources Conservation prevents their waste and makes sure of a supply for the future

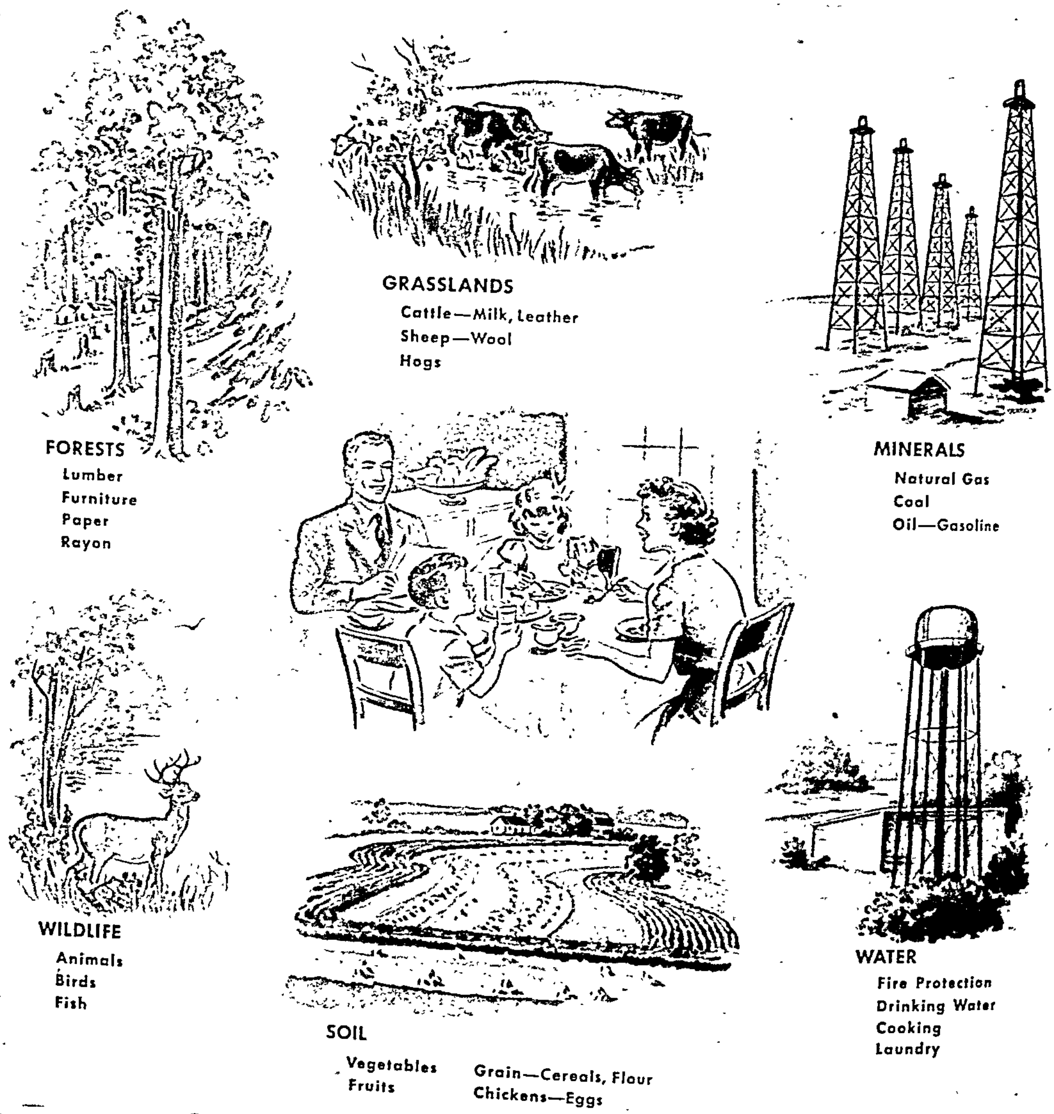
> **CONSERVATION PLEDGE**
> I give my pledge as an American to defend from waste, to work for wise use and good management of my country s natural resources—its soil and minerals, its forests, waters, and wildlife

Nearly everything we need for comfortable living today comes from one of the natural resources We cannot live five days without water Our food comes from soil On the grasslands live the animals that produce our meat, wool and leather From forests come the lumber for our houses and furniture, and pulp for paper Forests and grasslands are also important because they hold water in the ground and prevent soil from washing away We use minerals to heat our homes, cook our food, and run our automobiles Fish, birds, and wild animals all play a part in the *balance of nature* (*see* Nature Study)

When the white men first came to America they found a continent rich in natural resources Much of the land was covered with forests where wild animals lived in countless numbers Over broad grasslands wandered great herds of buffalo The soil was deep and fertile Swift-running streams and deep lakes held a wealth of fish

In their struggle to get food, clothing, and shelter the settlers chopped and burned down most of the eastern forests As they moved westward they plowed

HOW WE DEPEND ON NATURAL RESOURCES



This drawing shows that our food, much of our clothing, and countless other things depend on natural resources. How many things in your home and schoolroom can you list that come from soil, water, forests, grasslands, and minerals? Birds are wildlife. How are they useful? Do you think we can destroy our natural resources and continue to live in comfort?

up the grasslands to plant corn and wheat. Their growing cities dumped sewage and waste materials from factories into the lakes and streams.

But forests and grasses were needed to hold soil in place and to keep rain water from running to sea. When they were gone, less water was stored in the ground, because the plant cover that acts as a blotter was gone. When winter snow melted many rivers had floods. In the summer, with little rain, wells ran dry, and crops died in the fields. Dust storms blew the topsoil away. Animals and birds that once lived in the forests and on the prairies became scarce; some kinds vanished forever. Fish died in unclean waters.

At last people began to see that *their very existence depends upon using these resources wisely.* They began to understand that natural resources depend on one another and on people and that people depend on natural resources. They began to understand too that individuals have no right to destroy natural resources for their own profit. The lumber company that chops down all the trees of an entire state without replanting for the future; the industrial plant that poisons a river with its wastes; the farmer who neglects his own farm and so damages his neighbors' land are injuring not only themselves but their whole community. The campers whose care-

lessness starts a forest fire the automobile driver who wastes his gasoline the picnickers who tear up armfuls of wild flowers the hunter who kills more than the legal limit—all are destroying natural resources *Conservation in fact is the responsibility of everyone* In many cases it must be enforced by law to prevent waste and destruction

Conservation pays well in making a community a more beautiful place in which to live Wherever the land is mistreated the countryside is unattractive Vacant lots covered with weeds and trash bare roadsides and streams used as garbage dumps are ugly We do not like to look at them or to linger near them The recreational value of conservation *is another of its important* aspects As our cities grow more and more crowded people need places to visit on their vacations and week ends They need more city parks and county forest preserves more national parks more highways bordered by trees and flowers and sparkling streams

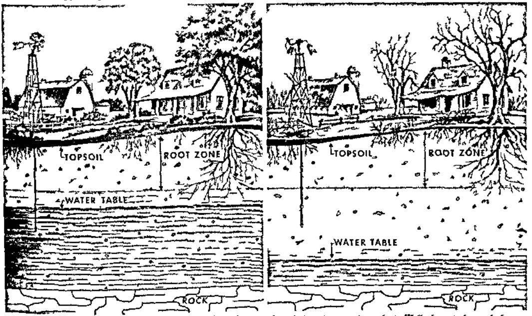
AN EXPERIMENT WITH RUNOFF

In these two tipped up boxes are earth planted with grass and bare earth The dishes below the boxes catch the water and soil that *run off when water is poured over the boxes Which* box will hold back the most water? Which will let the most water and soil run off? This experiment can also be made out of doors with larger boxes exposed to the rain

The study of conservation should start with one s own surroundings City people as well as country people can observe *erosion*—the silent thief that steals away our topsoil Most vacant lots suffer from some *erosion The wearing away* of soil shows at the end of drain pipes or where a building has been removed A bare road cut ridged with gullies and washing slippery mud over the highway during a rain is an example of erosion A road cut planted with bushes will leave the road clean after a rain

A fresh excavation for a new building is a good place *to study topsoil and subsoil* In a visit to the city water works one may learn where the water comes from how it is used and in what quantity and what measures are taken to protect its source Here are some questions everyone should ask himself Are the rivers lakes and streams of the community kept clean and fresh? How is the city s sewage and trash disposed of? What do the factories do with their waste materials such

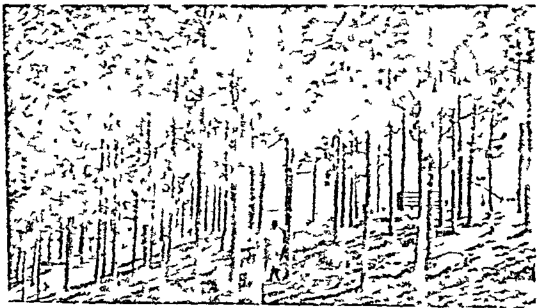
HOW A FARM GROWS POOR BY DESTROYING PLANT COVER



When plant cover is removed from the soil serious things begin to happen *The soil no longer holds* rain water It runs downhill carrying the topsoil with it The ground water table sinks so low that roots cannot reach it Wells have to be sunk deeper When there is little rain wells run dry and crops die in the fields The farm may become so poor that it has to be abandoned

RECLAIMING WASTELAND

This field was useless as cropland or pasture. Erosion by wind and water was ready to set in. The owner planted pine seedlings, and almost from the start erosion was checked.



Nine years after the seedlings were planted, as shown in the first picture, the field bore a healthy stand of pine. Now the owner periodically cuts selected trees and sells them for pulpwood.

as oil and chemicals? In the country, is the land well covered with grasses, shrubs, or trees? Is there a layer of dried grass, leaves, and twigs on the ground? Does the ground feel soft and springy underfoot? Are there gullies in the fields and pastures? Are the stream banks washing away? Are the streams muddy or clear? Are tin cans and other trash being thrown into the stream?

The Water Table and Watershed

All of us use water. Our homes must have it for drinking, cooking, and washing. Cities must have it for fire protection. Industries use it to produce electricity and for an endless variety of manufacturing processes. When we think of water we usually think of rain, rivers, and the ocean. We seldom think of the vast underground storage supply known as the *water table* (*see* Water). It is vitally important. Wells are sunk to the water table. Plant roots draw moisture from it. Springs and streams issue from it where it comes to the surface.

The area drained by a region's rivers and streams is called the *watershed*. Such an area slopes toward a common land trough. Some rain *runs off* (drains) over the ground surface. The runoff becomes a brook. Brooks flow into streams, streams join to form rivers.

A good watershed conserves water. It has a high water table, clear streams, and a generous cover of trees, grasses, and other plants. Plants help to form a part of the topsoil called *humus*. Humus consists of decaying leaves, bacteria, dead insects, and other animal remains. It provides some of the food for new plant life. Together with a network of roots, it acts as a blotter, soaking up rain. Plants break the force of falling rain and scatter the drops over leaves and branches. Some of the water returns to the air by evaporation. Part of the water is used by the plants and breathed out into the air again through the leaves by transpiration (*see* Plant Life, Trees).

The rest of the water sinks into the earth through countless tiny channels made by roots, earthworms, and burrowing animals and insects. The level at which the earth is permanently saturated is the water table. In a healthy watershed, this level is close to the surface throughout the year. During long, heavy rains the soil may not be able to soak up all the water. Some of it runs off the surface, but in a good watershed, it moves slowly. Deep snow also melts slowly and gradually soaks in.

A poor watershed is formed when all the trees have been cut down or burned off. Grasses and other plants have been stripped off by fire, over-grazing by livestock, or bad farming practices. Marshes and ponds have been drained to make more farm land.

BAD AND GOOD FORESTRY

Here unplanned logging, followed by fire, has destroyed not only the trees but the blanket of topsoil that once covered the forest floor. Rain water has dug out a deep ditch, or gully.

This picture shows good lumbering practice. Selected trees are cut from time to time, leaving the others to reach full height and to supply seeds for new growth. Erosion is impossible here.

Now when it rains there are no leaves and branches to break the force of the falling water The blotter of roots and humus is gone Mud is produced and closes the channels by which water moves downward If the land is level the water stands in stagnant puddles If the land is sloping the water races downhill into the rivers

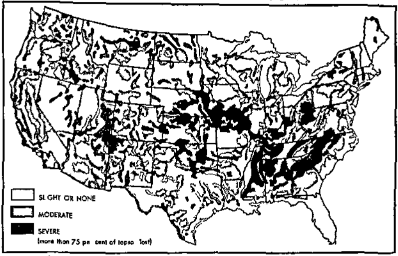
The watershed suffers destructive floods in the spring when heavy rains and melting snows overflow the rivers In the summer time when crops and livestock need water the streams springs and wells run dry for little or no water has sunk into the underground reservoirs Plants with shallow roots die because they can not reach the lowered water table There are fewer refreshing summer showers because trees and other plants are not breathing moisture into the air through their leaves

Soil and Erosion

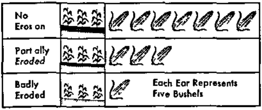
The streams in this mistreated watershed are no longer clear but a dark brown muddy color They are heavy with silt *For racing water does more than gallop off the land It also carries soil along with it*

Wherever we find a land stripped of its plant cover we find that the soil is going too by *erosion* The word *comes from two Latin words meaning 'gnawing away"* The article on Soil explains just what soil is how long it takes nature to make just one inch of it (500 to 1 000 years) and how important it is to life Topsoil is perhaps the most valuable of all our possessions It is that blanket of rich earth *and humus seldom more* than a foot deep which makes plants grow Underneath the topsoil is a sterile material called subsoil When the topsoil is blown or washed away plant life sickens and dies The people who live in the region grow poor and finally move away

EXTENT OF EROSION IN THE UNITED STATES



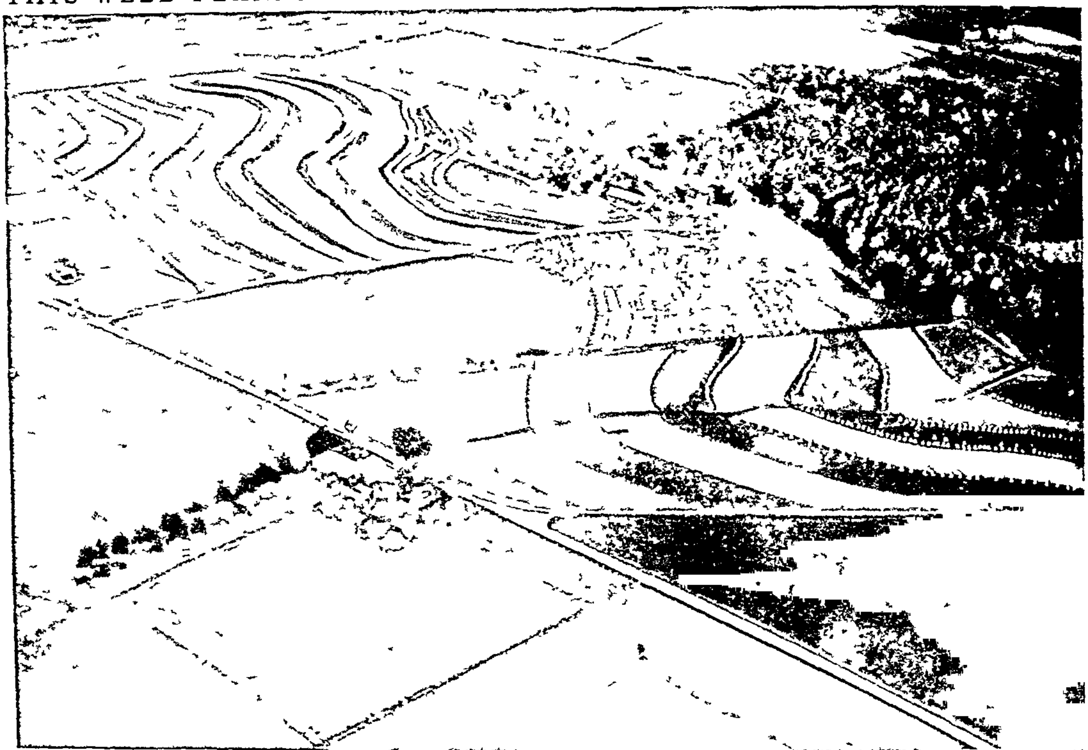
The map above shows that erosion has badly damaged about 280 million acres of crop and grazing land—equal to the combined areas of Illinois Iowa Missouri Kansas Nebraska and Wyoming Nearly three times that much land is partly eroded The chart below shows that as the topsoil which contains plant food is carried away, crop yields grow smaller



HOW EROSION MAY BE STOPPED

Soil erosion is not hopeless if something is done about it in time as shown in these two pictures The first shows an eroded field with a deep gully forming at the bottom of the hill The second shows the same field two years later The gully has been planted with locust trees The roots of the trees and fallen leaves hold moisture and prevent further washing away of soil

THIS WELL-PLANNED FARM WILL PRODUCE FOOD FOR GENERATIONS



This air view shows how wise farmers plant their crops to follow the curve of a hill, instead of running them up and down the hill. The light colored strips are row crops, such as corn or wheat. The dark strips are close growing "cover" crops, such as alfalfa or soybeans. This kind of planting is called "contour strip cropping." The row of trees, lower left, is a windbreak to protect the farm buildings and near-by fields. At the upper right is a wood lot.

It is estimated that erosion has severely damaged about 280 million acres of the grazing and cropland in the United States—equal to the combined areas of Illinois, Iowa, Missouri, Kansas, Nebraska, and Wyoming Another 775 million acres have eroded to some extent. We now have left about 460 million acres of land suitable for crops.

Erosion is caused by two different agents—wind and water. Dust storms are the evidence of *wind erosion*. Soil unprotected by plant cover simply blows away. On May 11, 1934, a great dust storm carried away an estimated 300 million tons of topsoil from the Great Plains states. On the basis of 1,000 tons of topsoil to cover one acre seven inches deep, that meant the equivalent of 7,500 forty-acre farms taken out of crop production in a single day.

There are several kinds of water erosion. *Sheet erosion* is the wasting away of level land in thin layers. It may go on for years without being noticed. But each year the land produces smaller crops Finally on some slight rise of ground, a patch of subsoil shows through. Then the land is about finished as a food producer.

Splash erosion is the washing away of soil by the direct battering of rain. Small channels dug in the soil by runoff are called *rill erosion*. The little rills run together and form a network of larger rills. Then gullies develop. *Gully erosion* is the last stage, and when this occurs the land is on its way to becoming a desert.

Gullying progresses at high speed in certain types of soil. In southwest Georgia is a famous gully called Providence Cave. In places it is 200 feet deep, with arms reaching in all directions. It began about the year 1890 from water dripping off the eaves of a barn. Since then it has destroyed 3,000 acres of farmland and swallowed the barn, a schoolhouse, a church, and roads. It is still reaching like an octopus toward other remaining farms.

Soil Fertility and Erosion

Erosion carries off good topsoil, thus reducing the fertility of the soil. This is because plant foods are in the upper levels of the soil. The loss of one inch of topsoil will reduce production of corn by four or five bushels to the acre. Moreover, plants on thin soil suffer from so-called "deficiency diseases"; that is, they lack certain vitamins and minerals. Such plants do not provide fully nourishing food for human beings and livestock.

Experts claim that we need at least two and a half acres of productive land to clothe each person and provide him with a minimum diet. As told earlier in the article, the United States has left about 460 million acres of good land. This averages about three acres for each person. The entire world is believed to have about 4 billion acres of productive land to

supply the needs of nearly 3 b ll on people Th s amounts to less than *two acres a person* The Un ted States can still care for ts own people but it s be ng called upon more and more to help the rest of the world

How Soil Conservation Works

The United States had no nat on al program of so l conservat on unt l bus ness depress on and drought came in the 1930 s In 1933 the So l Ero on Se vice (soon renamed the So l Conserva t on Service) as created as an emergency measure and made a ma *jor d n ion of the United States* Department of Agriculture

Demonstrat on projects vere set up in all parts of the country In 1937 the d fferent states began to pass laws perm tt ng farmers to organize the r own so l con*s*er a t on distr cts By Jan 1 1951 there were mo e than 2 300 such d stricts Each farm fits nto a district-wide plan Farmers often work in groups helping each other apply good land use measu es The So l Conservat on Service and other federal and state agenc es p ovide *techn cal advice*

Th s program promotes good land use measu es by fa mers all over the count y It empha zes that covering the ground with plants is one of the most m portant of all factors in conser at on because t holds rain water where it falls and prevents the blo ng and wash ng away of so l Gull es can be healed in many cases by new plants They provide a tangle of leaves and stems that traps and holds in place part of the soil carried by runoff Grass legumes shrubs and trees are planted in gull es for th s pu pose

HOW TO HOLD RAIN WATER IN DRY REGIONS

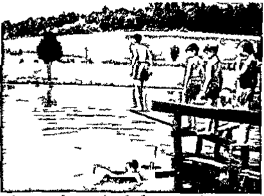
In d y oun y whe e e c y d op of a n must be saved the wa e s he d on he and n small ho ows made by a p ow ca ed a *bu n is er* C ops a e p an ed n he bot om of he bas ns

A spectacular gully healer w dely used n the South is *kudzu* It is a vine from the Or ent wh ch grows ve y rapidly It is not uncommon for gull es *ten feet* deep to become filled with n five years w th so l caught by the kudzu Kudzu provides good forage for livestock for t s rich in proteins

Another way to heal gull es s to bu ld dams of brush across them at regular intervals Then so l and water running down *tl* e gully are caught behind the dams and held in place The following pract ses prevent erosion from start ng

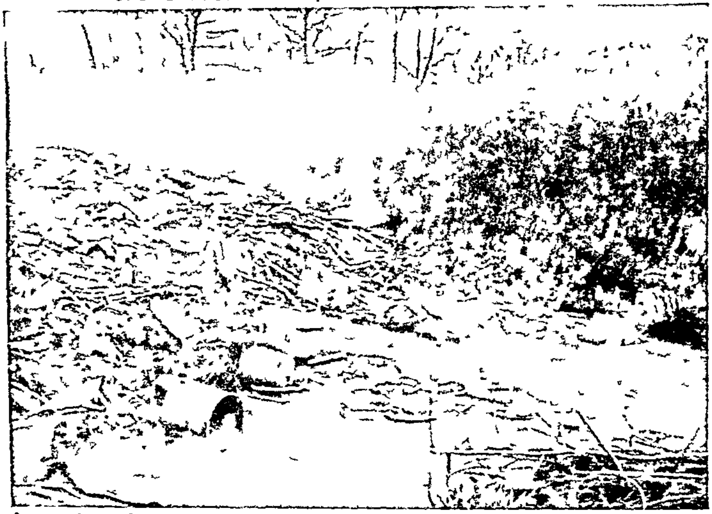
Contour ng Plo ving plant ng and cult vat ng sloping fields around hill ides w th curving furrows

HOW THE FARMER CAN HELP CONSERVATION



A li ng ose h dge ef , ns ead of barbed w e s o en used o keep a e f om s aying I s flowe s make the coun ys de beau ifu and p o des f od and sh e fo b ds and sma an ma s The fa m pond gh p ovides ec ea on fish fo the tab e she e and food fo du ks and o he wa e birds fire p o e on and a ese ve wa supp y fo lives o k

NO SWIMMING, NO FISHING HERE



A once beautiful woodland stream has been turned into an ugly garbage dump. No fish can live in its dirty waters No birds can nest among the tin cans on its shores. No swimming, no picnicking permitted.

horizontal to the hill, instead of furrows running straight uphill and downhill. The curved furrows catch rainfall and allow much of it to soak into the ground. They also catch soil washing from above.

Strip cropping. Planting strips of close-growing plants—such as grass or clover—between alternate strips of clean-tilled row crops, such as corn. The strips of close-growing plants hold water and keep it from eroding the cultivated strip below. These strips are planted on the contour.

Terracing. On long slopes a low ridge thrown along the outer side of the slope catches soil and rain water and slows down runoff.

Listing. In dry regions a special list plow can be used to throw a ridge of dirt to each side, creating a trough, or furrow, about 18 inches wide and 7 inches deep. Crops are planted in the bottom of the furrow. In *basin listing*, a dam of dirt is thrown across the trough at right angles, every 3½ to 20 feet.

Shelter belts. On the treeless plains belts of trees break the force of winds across a field and reduce wind erosion.

Deep tillage. Instead of turning over the earth with a moldboard plow, a deep-tillage plow breaks the earth below the surface, but leaves the surface vegetation, or trash from the previous crop, to act as a cover. This is also called *stubble mulching*.

Crop rotation. Planting different crops each year on a piece of land keeps the soil productive. One crop helps the next. For example, nitrogen, needed for plant growth, is added to the soil by *legumes* such as clover, alfalfa, and cowpeas. These plants can take nitrogen from the air and store it through their roots in the soil.

In a year or two, the plants can be plowed under. This is called *green manuring*. After the roots have rotted, other plants can use the nitrogen for growth. This helps plants, such as corn, cotton, and potatoes, that cannot store nitrogen. Rotations are used with strip cropping by shifting the close-growing strips and the tilled strips at fixed periods. Thus the same plan that stops erosion improves the soil.

Cover crops. Land is kept covered winter and summer with either a growing crop or the residue, such as cornstalks, from the crop previously grown When cover crops are plowed under for green-manuring purposes, the plant foods added to the soil increase its fertility and improve its water-holding capacity.

Fertilization is the use of manure or other fertilizer to replace plant food taken out of the soil by crop production.

Wildlife Conservation

Wildlife conservation goes hand in hand with soil and water conservation. Song and game birds, fish, furbearing animals, and big game animals are as much a product of the land as are trees and grain fields But wild animals, like human beings, must have food, water, and places to make their homes. Destroying the forests, marshes, ponds, and grasslands destroys their food and water supply and the places in which they live. Only a remnant of the original game supply of the United States now remains. The passenger pigeon, Carolina parakeet, great auk, Labrador duck, Pallas cormorant, and heath hen are extinct. Birds near the vanishing point include the whooping crane, ivory-billed woodpecker, and California condor. The number of moose, caribou, wild sheep and goats, grizzly and Alaskan brown bears grows smaller every year. Most wildlife is protected by law today from overhunting and overfishing. But if we continue to destroy their natural homes, they cannot survive.

The government has established numerous national wildlife reservations and game refuges. Many of these are administered by the Fish and Wildlife Service. All the national parks and monuments are wildlife refuges. Individuals, however, can do more than government bureaus in restoring wildlife to the countryside simply by providing birds, fish, and animals with natural breeding places.

Hedgerows confine livestock within fields just as effectively as wire fences and provide nesting places for many birds and cover for small animals. The multiflora (meaning "many flowers") rose is being used widely for this purpose. It grows rapidly and makes a very effective fence. Its flowers add beauty to the countryside in the summer, and many birds and animals like the fruit.

Brush piles scattered through a wood lot provide retreats for cottontails, weasels, mink, and woodchuck. Marshes seldom make good croplands, but they provide homes for muskrats and certain birds. (For a discussion of the importance of marshes and the dan-

LET US FOLLOW THE RAIN FROM FOREST TO SEA

The drawing at the left shows rain falling onto a forest. Some of it flows off the surface. Some sinks into the ground. Finally it reaches the sea (right). There the sun draws it into the air by evaporation and it falls again as rain or snow. The center picture shows how man can save water and make it work for him. Where the rain and snow fall in the mountains the land should be kept in forests. A dam across the river makes a lake called a reservoir. The dam prevents floods downstream and saves the water for irrigation. A power plant at the dam uses the force of the flowing water to generate electricity for farms and cities.

ger of unwise drainage (*see* Birds, section on "Protecting and Conserving Our Birds.")

A farm pond serves many purposes. Its water is at hand for fire protection and to provide an emergency water supply for livestock. Fish can be raised in the pond (*see* Fish Culture). Ducks and other water birds may nest on its borders. It is a swimming pool in the summer and a skating rink in the winter. Some farmers make money from ponds by renting automobile parking space to picnickers.

The Problem of Water Pollution

Clean water is essential to life. Yet many waterways are used as dumps for raw sewage, garbage, and industrial wastes. Water pollution comes from three major sources. First, our cities, towns, and villages dump untreated sewage and garbage into the nearest streams. Second, industries discharge wastes consisting of acids, chemicals, greases, oils, and animal and vegetable matter. Such materials poison drinking water and endanger public health. They destroy commercial fisheries. They prevent fishing, boating, bathing, and other recreational uses of the poisoned waterways.

Good progress is being made in correcting these abuses. In 1948 a Division of Water Pollution Control was set up in the federal Public Health Service. It is stimulating a broad national program for the prevention and control of pollution. Many states have passed water control laws providing that municipalities and industries may be ordered to build sewage and waste treatment plants. Progressive industries are engaging in research on the recovery and re-use of waste by-products. Often such by-products more than pay for the cost of recovery. One manufacturer of strawboard collects enough methane from wood pulp liquor, which was formerly emptied into the river, to furnish not only light and power for his plant but also a profitable surplus.

A third source of water pollution is *siltation*. Streams flowing through eroded land carry soil, or silt, suspended in their waters. A heavy load of silt indirectly kills fish because it reduces the amount of oxygen in the water. Wherever the flowing water slows down, the silt is deposited. Reservoirs behind dams soon fill with silt unless the watershed above the dam is protected against erosion.

Conservation of Minerals

Soil, water, forests, grasslands, and wildlife are the *renewable* natural resources. Minerals, once exhausted, can never be replaced. The United States has a priceless heritage in its great stores of coal, oil, natural gas, and minerals that were deposited ages ago. Until Congress passed the Mineral Leasing Act (1920), discovery of these resources on public lands led to their transfer to private individuals, who sometimes developed them by wasteful methods. Government regulation now helps private enterprise to develop these resources with less waste.

For years coal had been mined as though it were inexhaustible—about one ton wasted for each ton mined. Now it is being mined more economically. By use of water power instead of coal to generate electricity wherever possible, the coal supply may last indefinitely. (*See also* Coal; Water Power.)

Natural gas and petroleum were once carelessly wasted. In the earlier days, natural gas was allowed to escape into the air because there was no way to use it. Various state and federal measures and co-operation within the oil industry are combating overproduction and waste (*see* Gas, Natural). Atomic energy is a new source of power which may some day replace all the minerals used for fuel.

The salvaging of waste metals, once called "junk," has been dignified with a new term, "secondary production." This has grown to be an important business.

Conservation in the United States began as a movement to save the vanishing forests but soon broadened to include other resources. Gifford Pinchot, forestry expert and later governor of Pennsylvania, was a leader in conservation work. He strongly influenced President Theodore Roosevelt, who established the National Conservation Commission. Under this commission, 234 million acres of government-owned timber, coal, oil, and phosphate lands were set apart as public lands, never to be sold to private interests. In 1935 another 197 million acres of unreserved public land were withdrawn from sale and set aside for the public.

Under President Franklin D. Roosevelt, reforestation and erosion control were undertaken by the Civilian Conservation Corps and the Soil Conservation Service. Abandoned and submarginal farms were taken over; many were reforested and set aside as game reserves. Conservation of natural resources was one of the major aims of the Tennessee Valley Authority. The repurchase of forest land has been hastened. The Taylor Grazing Act (1934) controls grazing of livestock on public lands to prevent overgrazing and soil deterioration. The Bureau of Land Management in the federal Department of the Interior is concerned primarily with co-ordinating the conservation activities of all the government's various branches.

HELPING THE AGED STAY WELL

Here a visiting health department nurse is giving medical aid to an elderly woman in her home. Care of the aged is an important part of the work of conserving human resources.

Conserving Human Resources

A nation must conserve its human resources as well as its natural resources. The physical and mental health, energy, and time of its people are a country's most valuable assets. To conserve these assets the national, state, and local governments spend millions of dollars annually. Many of the services they provide, such as pure drinking water and sewage and garbage disposal, are so common that we rarely consider the part they play in conserving human resources.

CHECKUPS MAINTAIN GOOD HEALTH

This optometrist is examining the boy's eyes with instruments that measure ability to see. Periodic checkups on eyes, teeth, and the whole body do much to conserve good health.

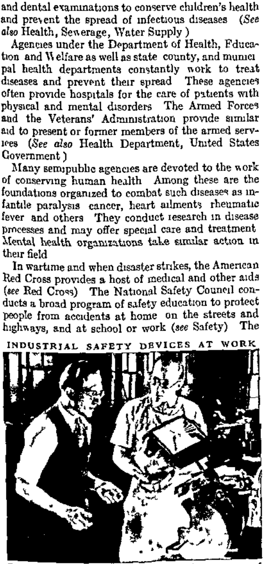
To protect health, governments at all levels have laws, ordinances, and regulations that establish disease-control action A person suffering from a disease spread by human contact may be kept apart from other people Special hospitalization as in leprosy, or quarantine, as in some childhood diseases, provide both treatment for the patient and protection for others Vaccination as in smallpox or inoculation, as in tetanus are frequently required to protect people from specific maladies Farm animals may be destroyed when they have such diseases as tuberculosis or hog cholera which may be transmitted to humans Schools often conduct medical and dental examinations to conserve children's health and prevent the spread of infectious diseases (*See also* Health, Sewerage, Water Supply)

Agencies under the Department of Health, Education and Welfare as well as state county, and municipal health departments constantly work to treat diseases and prevent their spread These agencies often provide hospitals for the care of patients with physical and mental disorders The Armed Forces and the Veterans' Administration provide similar aid to present or former members of the armed services (*See also* Health Department, United States Government)

Many semipublic agencies are devoted to the work of conserving human health Among these are the foundations organized to combat such diseases as infantile paralysis cancer, heart ailments rheumatic fever and others They conduct research in disease processes and may offer special care and treatment Mental health organizations take similar action in their field

In wartime and when disaster strikes, the American Red Cross provides a host of medical and other aids (*see* Red Cross) The National Safety Council conducts a broad program of safety education to protect people from accidents at home on the streets and highways, and at school or work (*see* Safety) The

INDUSTRIAL SAFETY DEVICES AT WORK



The worker (right) is showing the inspector how a portion of his grinding wheel flew off and cracked the transparent guard Thanks to the guard, the worker himself was not injured.

Red Cross also maintains a special program of water safety instruction Fire and police departments are ready to act in emergencies that menace human health (*see* Fire Department, Police)

Conserving Time and Energy

Time and energy are valuable human resources To conserve them, the modern business and industrial world makes use of countless timesaving and labor-saving machines, devices, and methods Time and motion studies help workers conserve energy and promote production Machines now do the work of many men (*see* Work and Fatigue) Psychological tests enable people to choose the kind of work for which they are fitted (*see* Intelligence Tests Personality) Homemakers today can avail themselves of many appliances that save time and strength, home furnishings that are easy to keep clean and foods that require little preparation (*see* Food Preservation Home Economics and Management)

Many physically handicapped people are able to perform a wide variety of jobs sometimes more skillfully than workers without handicaps Today their human resources are being used in many different fields With proper vocational training and psychological counseling, handicapped people can often learn to become economically useful and socially well adjusted (*See also* Deaf, Education of, Blind)

Increasing attention is being given the problem of conserving the human resources of elderly people Employers are learning to adjust time and production schedules for older workers, and their health is the subject of a special medical field, called *geriatrics*. (*See also* Leisure)

Conservation Organizations

The following nongovernmental organizations are concerned with various aspects of conservation All publish books, magazines, pamphlets, all engage in educational and research work, all have films available to schools and clubs

AMERICAN FORESTRY ASSOCIATION, 919 17th St, N W, Washington 6, D C *American Forests* published monthly Founded in 1875, it was largely responsible for creation of U S Forest Service and Civilian Conservation Corps

AMERICAN NATURE ASSOCIATION, 1214 16th St, N W, Washington 6, D C. *Nature Magazine* published during school year

CONSERVATION FOUNDATION, 30 East 40th St, New York City Sponsors research and education related to the interdependence of natural resources and their wise management

EMERGENCY CONSERVATION COMMITTEE, 767 Lexington Ave, New York City Largely responsible for the creation of Olympic National Park Maintains the Hawk Mountain (Pennsylvania) sanctuary for hawks

FRIENDS OF THE LAND 1368 North High Street Columbus 1, Ohio Established in 1940 "for the conservation of soil, rain and man", *The Land* quarterly magazine, *The Land Letter* quarterly news bulletin

Garden Club of America, Conservation and Roadside Committee, 15 East 58th St., New York 22.

Izaak Walton League of America, 31 N. State St., Chicago 2, Ill. Promotes the conservation of fish, woods, water, and wildlife; encourages the establishment of game preserves, reclamation of polluted streams; organizes Junior Leagues to interest children in conservation. *Outdoor America* published ten times a year.

National Audubon Society, 1130 Fifth Ave., New York 28. For description of the work of the Society, *see* Audubon.

National Parks Association, 1214 16th St. N.W., Washington 6, D. C. Publishes quarterly *National Parks Magazine*. Established 1919 to "promote the preservation of primeval conditions in the national parks and in certain national monuments, and to maintain the high standards of the national parks ... to preserve wilderness country and its virgin forests, plant life and wildlife ... in the nation."

National Roadside Council, 119 East 19th St. New York 3. Is concerned with the preservation of roadside beauty.

National Wild Flower Preservation Society, 3740 Oliver St. N.W., Washington, D. C. (*See also* Flowers.)

National Wildlife Federation, 3308 14th St. N.W., Washington, D. C. Publishes monthly *Conservation News Letter* on pending legislation; wildlife conservation stamps.

Nature Conservancy (formerly the Ecologists Union), 1214 16th St. N.W., Washington 6, D. C. Devoted to the preservation of nature reserves—forests, prairies, marshes, deserts, and other natural features not now preserved.

Wilderness Society, 1840 Mintwood Place N.W., Washington 9, D. C. *The Living Wilderness* published quarterly. Works for the preservation of forests and wilderness areas on private lands not under government protection.

REFERENCE-OUTLINE FOR STUDY OF CONSERVATION

CONSERVATION OF NATURAL RESOURCES

I. The five natural resources C-451: water W-60-4, C-452b-c; soil S-226-31; forests and grasslands F-236-41, G-168b-170; wildlife C-452f-453; minerals C-454
   - A. The wise use of natural resources C-451
   - B. All living things are interdependent—the natural resources depend on one another and on man, and man depends on natural resources C-452-452a, E-220, B-191-2, N-63

II. Water—all life requires water C-452b, W-60: animals A-250b-c; plants P-292
   - A. The water, or hydrologic, cycle W-61-2, E-181, F-143, picture C-453
   - B. The watershed and water table C-452b, W-62, D-154
   - C. Pollution problem C-453-4, picture C-452f: sewage disposal S-110
   - D. Control of water supplies by dams and irrigation D-6-11b, I-249-53
   - E. Dangers of artificial drainage B-194

III. Soil—food comes from the soil S-226-31. See also the Reference-Outline for Agriculture

IV. How plants hold water in the ground and prevent soil erosion C-452b, F-145-6: grasses G-167, D-154; trees F-236, T-179

V. What happens when the land is stripped of plants C-452, 452c, F-236, pictures C-452a
   - A. Lowered water table C-452b-c
   - B. Floods F-143-6
   - C. Drought D-152-5
   - D. Erosion C-452c-d, D-154, E-181, F-146, pictures E-219, L-97, U-317: fertility and erosion C-452d-e, chart C-452c
   - E. Deforestation F-237-8, 238-9, 239a, T-179, pictures C-452b
   - F. Overgrazing by livestock: in forests F-239; on grasslands D-154, G-170

VI. How to prevent erosion and conserve water resources C-452e-f, L-93-7, A-69
   - A. Putting the land to the use for which it is best suited L-93-7
   - B. Good farming practices C-452e-f, picture C-452d
     1. Restoring plant cover: in gullies C-452e, pictures C-452c, U-317; on overgrazed range land, pictures E-217; on embankments, picture E-219
     2. Contouring and strip cropping C-452e-f, D-154, pictures A-69, C-452d, L-97
     3. Crop rotation C-452f, F-25: role of nitrogen-fixing plants in rotation N-240-1, A-151
     4. Use of fertilizers C-452f, F-55, picture S-231
     5. Shelter belts C-452f, F-241
     6. Farm ponds C-453, F-112, picture C-452e
   - C. Protection of forests:
     1. Reforestation F-239, pictures F-239a
     2. Selective logging F-239, L-342, picture E-219
     3. Control of stock grazing F-239
     4. Utilization of wood wastes L-350
     5. Prevention of loss by fire and insects F-237-9

VII. Wildlife conservation C-452f-453, B-191, E-216-18, N-63
   - A. Birds B-190-6, E-216, pictures B-195, E-221: ducks D-161; laws B-194, 195, D-161, P-76, Q-1
   - B. Fish F-110-12: oysters O-439; salmon S-29
   - C. Fur-bearing animals F-326
     1. Humane trapping T-176-7
     2. Restoration of muskrat marshes in Manitoba M-79, picture M-80
   - D. Other animals: alligators A-171; beaver B-92; bison B-200; seal S-89-90; whale W-114
   - E. Protective organizations C-454a-b, B-195
     1. Federal Fish and Wildlife Service U-363-4
     2. Ducks Unlimited D-161
     3. National Audubon Society A-471
     4. Defenders of Furbearers T-176-7
     5. Humane societies H-443
   - F. Sanctuaries and game refuges A-471, B-195, F-163, N-21: foreign game preserves N-39
   - G. Good farm practices C-452f-453: multiflora rose hedge, picture C-452e

VIII Minerals—the nonrenewable resource C-451 petroleum P-181 natural gas G-33 water power conserves coal W-67 70 new sources of power A-470 F-315, P-403

IX Regional planning L-96 picture C-453 Tennessee Valley Authority T-69-70 proposed Columbia Valley Administration C-415b Missouri Basin Inter Agency Committee M-326 foreign planning L-96

X Population and food supply C-452d-e L-95

CONSERVATION OF HUMAN RESOURCES

I Conserving health and strength C-454-454a
 A Promoting good health H 300-7 physical education and athletics P 227 8 A-449-50 parks and playgrounds P 86a-d mental hygiene M 172 3 See also the Reference-Outlines for Physiology, Health and Medicine and for Food
 B Preventing poor health and disease H-300-307 public health H 308-10 first aid F 94-8 medicine M 164-5 antiseptics and antitoxins A 265-8 A 268-9 serum therapy S-103-4
 C Preventing accidents S-3-12 See also the Reference-Outline for Safety Education

II Conserving abilities C-454a education E-238-63 vocations V-499-515 See also the Reference-Outlines for Education and Vocations

III Providing for social security S-218-18a See also the Reference-Outline for Sociology

IV Providing new leisure in daily living L-158-61 hobbies H-387-401 See also the Reference-Outline for Vacation Activities

HISTORY OF CONSERVATION

I In the United States C-454 B 194-5 F 240-1 L-92
 A Mistakes of the settlers C-451 2 L-94-5
 B Theodore Roosevelt administration R 224
 C Taft administration T-3-4
 D Franklin D Roosevelt administration C-454 Civilian Conservation Corps R-205 F 241 N-38e Soil Conservation Service C-452e A 69
 E Government agencies interested in conservation: Department of the Interior U-362-4 Department of Agriculture U-364-5 Tennessee Valley Authority T 69 70
 F Nongovernment agencies C-454a b National Audubon Society A-471

II Conservation in other lands
 A Ancient Incas practiced conservation principles picture I-51
 B Good forestry practices in Germany B-203
 C Countries which failed to conserve natural resources China F 239a Mexico M 199

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CONSTABLE, JOHN (1776–1837) Early in the 19th century most English painters believed that "a good picture like a good fiddle should be brown" John Constable believed that nature should be shown in its own colors He invented a technique to make this possible Instead of using flat colors he painted with thick daubs and flecks of many hues He is said to have used "a thousand greens" to create the natural beauty of his trees and meadows To suggest the high lights of sunshine he used dashes of light-colored pigment known as "Constable s snow"

England was slow to appreciate him He painted portraits to earn money, while his landscapes remained unsold France however acclaimed his revolutionary method His Hay Wain shown at the

Paris Salon of 1824, inspired the French romantic leader Eugène Delacroix to repaint part of his own 'Massacre at Chios'. Constable's technique helped lead the way to the French Impressionism movement in painting.

Constable was born in the village of East Bergholt, the son of a prosperous miller. In his boyhood he roamed the Suffolk countryside. "These scenes," he said, "made me a painter." At 22, after two years as a clerk in his father's business, he went to London to study painting at the Royal Academy. In 1811 he fell in love with Maria Bicknell. Her family did not approve of the match, and they did not marry until 1816. Maria died in 1828, leaving Constable with seven children, the youngest less than a year old. In 1829 the Royal Academy elected him a member.

Constable's best-known works include 'The Leaping Horse', 'Dedham Mill', and 'Salisbury Cathedral'.

CON'STANTINE THE GREAT, ROMAN EMPEROR (A.D. 280?–337). Two important events marked the reign of Constantine the Great, the first Christian emperor of Rome. He made Christianity a lawful religion; and he founded the city of Constantinople, the brilliant capital of the Eastern Roman Empire.

Flavius Valerius Constantinus was born in the Roman province of Moesia (later Serbia) about A.D. 280. His father, Constantius, was a member of an important Roman family. His mother, Helena, was the daughter of an innkeeper. In 293 the emperor Diocletian made Constantius *caesar* (emperor) of Gaul and Britain. Young Constantine was kept at the court of Galerius, the eastern emperor, virtually as a hostage. He escaped in 305 and joined his father. Constantius died the next year and the army hailed Constantine as caesar.

For five years Constantine contented himself with ruling Gaul. Then he invaded Italy, making straight for Rome. When he reached the Tiber River, he wrote, he saw in the afternoon sky a bright cross. On it were the words *Hoc signo vince!* ("In this sign conquer!"). He dreamed that night that Christ bade him take the cross for his standard. The next morning (Oct. 28, 312), Maxentius, emperor of Rome, came out of the city with his army and met Constantine at the Milvain Bridge. Constantine swept the enemy into the Tiber, and Maxentius was drowned. Constantine then entered Rome as sole master of the western half of the empire. To commemorate his victory he erected the triumphal Arch of Constantine. In 313 he issued the famous Edict of Milan. This gave the Christians the right to practice their religion openly.

Constantine Calls a Church Council

By 323 Constantine had brought the entire Roman world under his own rule. He then gave his attention to a quarrel that threatened to split the Christian church into two camps. Arius, a priest of Alexandria, Egypt, maintained that Christ was not the equal of the Father but was created by Him. Athanasius, leader of the bishops in the west, claimed that the Father and Son, though distinct, are equal, and of the same substance. To settle the matter, Constantine called together in 325 a world-wide (ecumenical) council of bishops at Nicaea, in Asia Minor. He himself presided. An overwhelmingly majority condemned the Arian view as heresy. The Council drew up the Nicene Creed, which is still accepted as the basic doctrine of most Christian churches.

The Founding of Constantinople

Constantine next moved his seat of government from Rome to the east. He did this to secure better protection from Asiatic foes. He realized also that the Roman Empire drew its strength from the productive lands of the east rather than from Italy. For his capital he chose the ancient Greek city of Byzantium on the Bosporus. He enlarged and enriched the city at enormous expense. In 330 it was dedicated as "New Rome"; but it was generally called Constantinople, "the city of Constantine." Within a century and a half, the western, Latin-speaking part of the empire was overwhelmed by Germanic barbarians. The eastern or Byzantine Empire, with its capital at Constantinople (now Istanbul) survived for more than a thousand years (*see* Byzantine Empire; Istanbul).

Constantine ruled as a despot, surrounded by oriental pomp. He admitted bishops to his council; and his laws concerning the treatment of slaves and prisoners show the influence of Christian teachings. However, he put to death his oldest son, Crispus, and his second wife, Fausta. Not until his last illness did he fully accept Christianity. Then he cried, "Let there be no ambiguity!" and asked for baptism. Laying aside his purple imperial robes, he died in the white robe of a Christian neophyte. Before his death he divided the empire among his three remaining sons.

The Donation of Constantine

In the 8th century the church came into possession of a document that purported to be a decree of Constantine. It stated that the emperor, in gratitude for his conversion by Pope Sylvester, turned over to the pope and his successors the rule of the western empire. For centuries the popes based their claim to temporal power on this "donation." In the 15th century it was proved to be a forgery.

CONSTANTINOPLE. This former capital of Turkey occupies a strategic position on the European shore of the Bosporus, where it opens into the Sea of Marmara. In 1930, by order of Kemal Ataturk, Istanbul was made the official name of the city (*see* Istanbul).

CONSTELLATIONS. For untold thousands of years men have traced the outlines of familiar things among the stars. These patterns in the night sky are called *constellations*, from Latin terms meaning "together" and "stars."

Many of the constellations have names that are very old. The Sumerian shepherds and farmers of Mesopotamia 7,000 years ago may have called the Bull, the Ram, the Lion, and many other constellations by the same names we use. Students of history are sure these names started in Mesopotamia because the choice of animals suggests this. If the names had first been used in Egypt, there ought to be a hippopotamus or elephant among the stars. If they had started in

ancient India there should be a tiger or crocodile (*See also* Astronomy Zodiac)

The later people of Mesopotamia took over the old Sumerian names for the constellations and still later the Greeks adopted them The Greeks added many names of heroes and demigods to the list of constellations The Romans used the Greek list but translated the names into Latin To this day the official names of all the constellations are the Latin ones

About A D 150 the famous astronomer Ptolemy listed 48 constellations known to him in his book the Almagest (*see* Ptolemy) His list of constellations did not cover the entire sky There were blank spaces between constellations and there were no constellations at all for the southernmost stars because these could not be seen from the Mediterranean region In later centuries astronomers added constellations to Ptolemy s list to fill in the blanks Some of these later constellations are named for scientific instruments such as the Sextant the Compasses and the Microscope Others bear the names of birds and beasts in tropical regions (the Giraffe the Chameleon the Toucan) Today 88 constellations are recognized by astronomers

Importance of the Constellations

Everyone will find it valuable to know the principal constellations which can be seen from where he lives It is always pleasant to recognize them Frequently it is useful as well for we can tell time and find directions at night by the stars The article on Astronomy tells how to do this with the northern stars Once a person knows all the principal constellations he can do so with any of them

Some of the constellations are good likenesses but most are not It is easy to make out the hunter Orion with upraised arm and studded belt Cygnus the Swan really looks like a long necked bird with wings outstretched in flight It takes little imagination to see the spreading horns and narrow face of Taurus the Bull However Ursa Major (the Great Bear) does not look like a bear because bears do not have long tails So the Big Dipper is probably a better name for the seven brightest stars of this constellation Scorpius makes a fair scorpion but Sagittarius nearby looks little like an archer It makes an excellent teapot however and in late summer it can be seen pouring tea on the scorpion s tail

To most people a constellation is a group of bright stars but to an astronomer it is a definite area in the sky Thus every star no matter how dim lies in one constellation or another just as any point in the United States is in some one state The boundaries of the constellations used to be very irregular and had many curved lines In 1928 astronomers straightened them out so that the outline of any constellation includes only straight lines running north and south or east and west Astronomers use the constellation names to identify most bright stars and all variable stars so it was important to make the boundaries clear and precise (For maps showing the constellations and their monthly positions *see* Star)

CONSTITUTIONS Every civilized nation every state in the Union and almost every formal organization or club is controlled by a set of fundamental laws and principles known as a constitution This sets forth the form of government the powers and duties of its officers and the rights and responsibilities of its people or members

Most constitutions are written documents especially prepared and officially adopted on a certain date A notable exception is the unwritten constitution of Great Britain This nation is governed by a body of legislative acts judicial decisions and political precedents that have been established over a long period of time In actual practice governments with written documents are also controlled by a body of laws decisions and customs that have grown up around the original constitution

Constitutions of Nations and States

When a new nation is formed it usually draws up a written constitution The constitutions of the United States and the nations that grew out of the two World Wars were formed in this way Some nations have adopted new constitutions after revolutions which took place because there was no legal means of changing unsatisfactory governments Other nations have acquired their constitutions by grant of their rulers Through pressure or fear of revolution the rulers agreed to limited powers and government according to specified procedures and principles

In the United States all the original 13 colonies drew up written state constitutions during the Revolutionary War period Since that time every territory applying for statehood has had to submit its proposed constitution to Congress for approval

Constitutions must undergo change to meet new conditions Some changes occur through custom and usage or through interpretations made by courts Other changes are made by amendment *Flexible* constitutions are easily amended *rigid* constitutions are amended only by special convention or other elaborate methods In determining the meaning of a constitution the document may be interpreted *loosely* or *strictly* Loose interpretation recognizes implied and resultant powers strict interpretation denies all powers not specifically enumerated

Constitutions for Organizations

Preparing a new constitution requires much study and consideration The following principles should prove useful in constructing a constitution for any type of group

1 The constitution should be written This may prevent many needless misunderstandings

2 It should fit the needs of the specific group for which it is intended Few constitutions can be successfully borrowed from another organization

3 It should be as simple as possible and include only items of a permanent nature

4 The constitution should grant equal rights to all the members of the organization

5 It should include definite workable provisions for amending with a reasonable amount of difficulty

The Fine Art of CONVERSATION *and* HOW *to* MASTER IT

CONVERSATION. Four thousand years ago, schoolboys in Egypt were copying maxims on conversation from a book called 'The Instructions of Ptah-Hotep', preserved today in the Bibliothèque Nationale in Paris. It is spoken of as "the oldest book in the world," for it was composed sometime between 3000 and 2500 B.C., by a high official of the Egyptian government. So we know that long, long ago people realized the importance of conversation, and that studying the technique of conversation is nothing new.

Talking has been one of man's chief occupations and one of his most significant activities. History has been made at conferences; chance remarks have founded lifelong friendships; and from conversation has come inspiration for great achievements. Conversation is the means by which we draw near to one another with sympathy and pleasure; it is the basis of our social activities. It is no wonder then that those adept at conversation have always had an advantage in life.

A person's character and tastes are revealed by his conversation. That is the meaning of the old fairy tale about the two sisters. When one spoke, jewels fell from her lips; when the other spoke, toads jumped from her mouth. How well you know the sort of girl Alice was from her talks with the creatures in Wonderland! And so it is with peoples. The more civilized a nation is, the higher the level of its conversation.

> *A word fitly spoken is like apples of gold in pictures of silver.*—PROVERBS OF SOLOMON.
>
> *The most profitable and most natural exercise of our mind is conversation. To me it is a more agreeable occupation than any other in life.*—MONTAIGNE.
>
> *Wise, cultivated, genial conversation is the last flower of civilization.*—EMERSON.
>
> *Talk, which is the harmonious speech of two or more, is by far the most accessible of pleasures. It costs nothing in money; it is all profit; it completes our education, founds and fosters our friendships, and can be enjoyed at any age and in almost any state of health.*—R. L. STEVENSON.
>
> *Conversation is our solace, our inspiration, and our most rational pleasure.*—AGNES REPPLIER.
>
> *Talk often, but never long; in that case, if you do not please, at least you are sure not to tire your hearers.*—CHESTERFIELD.
>
> *A single conversation across the table with a wise man is better than ten years' study of books.*—LONGFELLOW.

Some Famous Masters of the Art

The ancient Greeks excelled in conversation, and the greatest talker of them all was the philosopher Socrates, who taught his followers to think by conversing with them. His most famous pupil, Plato, recorded some of his supposed conversations, and we can read them in 'The Dialogues' of Plato. In many classrooms today, Socrates' method of teaching is used, with a conversation about books or places or events taking the place of the stiff recitation.

In London in the 17th century, the coffee houses were centers of intelligent and witty conversation, particularly Will's Coffee House in Covent Garden, where the poet Dryden and his friends gathered. This reputation of the London coffee houses was carried on in the succeeding age by Dr. Samuel Johnson and his companions. These included such distinguished men as Goldsmith, poet and author of 'The Vicar of Wakefield'; Edmund Burke, the statesman; Sir Joshua Reynolds, the portrait painter; David Garrick, the actor; and Sheridan, the dramatist. Of the men and women who live in fame today chiefly because of their unusual ability as conversationists, Dr. Johnson is the most widely known. Few read Johnson's books now, but all who read at all know about his remarkable talk as it is recorded in Boswell's 'Life of Johnson'. (*See* Johnson, Samuel.)

However, conversation is generally considered to have reached its zenith in 18th-century France. At the houses of various talented women in Paris, leaders in art, science, philosophy, politics, and literature assembled regularly for dinners, suppers, or receptions and engaged in brilliant conversation. The hostesses, instead of dominating the conversation, encouraged their guests to talk freely—which is the art of every good conversationist. These salons, as the gatherings were called from the French word for drawing-room, exercised great influence on the political and literary history of the time.

Talk and Conversation

Much has been written on the art of conversation, and it is interesting to see how much alike the thoughts about it have been through the centuries. Nearly all commentators have stressed the difference between great talkers and great conversationists. Irrepressible talkers kill conversation and exhaust a company. Macaulay, the historian, is often mentioned as an example of one who never learned the important art of listening. The poet Coleridge was another man who sometimes monopolized talk. There is a story that he once buttonholed a friend and began talking with his eyes closed, as was his custom. The friend, having to leave, quietly snipped off the button with his knife, only to return hours later and find Coleridge still talking.

In addition to lecturers like Macaulay and monologists like Coleridge, there is another overtalkative type—the rambler who remembers all and tells all, only forgetting what he started out to say. The perfect example is Miss Bates in Jane Austen's 'Emma'. Mrs. Nickleby in Dickens' 'Nicholas Nickleby' is another whose thoughts jump aimlessly about like grasshoppers. "Parrot-talkers" have a stock of tried remarks for all occasions. Two centuries ago, Swift wrote a satire made up of remarks guaranteed to have been in use for a hundred years or longer. Even today, many are still

using some of these expressions, such as "Every one as they like, as the good woman said, when she kissed her cow", "The sight of you is good for sore eyes", and 'I love tea, but it does not love me" A collection of more modern hand me-downs of talk can be found in 'Are You a Bromide?' by Gelett Burgess among them 'The world is such a little place after all", and "Now that you have found the way, do come often"

A CONVERSATION AT THE CHESHIRE CHEESE

Doctor Johnson, who is shown in this old print talking to Boswell (facing him) and Goldsmith, was one of the most brilliant talkers on record In fact his conversation as recorded by Boswell, is better than anything he ever wrote

Some young people and older ones too go to the opposite extreme They try too hard to say things in a different way, and their talk sounds forced There are the schoolboys in 'Stalky & Co' "I wasn t goin' to damp his giddy ardor," McTurk says "Keep your hair on! We mustn t make a fuss about the biznai" Stalky advises We feel sure that these youths will outgrow their overeagerness to be original

"Overtoppers" might be a good name for those who must outdo any story or statement Children begin by boasting that their houses are larger, their fathers more important than those of their playmates They are quick to say, "That's nothing I can jump twenty feet" or 'I ve been to the circus five times" As they get older, they may, a little less rudely leave off 'That's nothing" without losing the overtopping habit "Yes, I m sure that was interesting" they say hastily as you finish your story, then add 'but you ought to hear what happened to me on my vacation" If you tell a joke they must tell a funnier one

What Makes a Good Talker

The best talkers of all ages appear to have had a lively affection for and a warm interest in their fellow creatures, a curiosity about the world in general (not a petty curiosity about people's affairs), some powers of observation and reflection, respect for their own opinions and tolerance for those of others, and tact, which comes from ready sympathy and quick thinking And they talked for the fun of it, not to show off their knowledge

A fund of information the talker needs, of course But you can get interesting topics to talk about by watching ants or listening to children at play, as well as by reading newspapers and books Finding out a great deal about one thing is helpful, because a person usually talks well about a subject he knows That is why having a hobby may make one a better talker

Humor

To be an interesting talker, you also need the ability to see the humor in everyday incidents and to tell about them in a way that will amuse others Amusing things occur around you constantly—in the street the bus the yard, the schoolroom, you have only to observe them to have diverting stories to tell In biographies and elsewhere in your reading, you will come across anecdotes that may enliven conversation But remember that the champion joke-teller is a pest Jokes help to season conversation, but like any seasoning they are not good for a steady diet

Kindliness is the basis of the most pleasing humor Sarcasm, the kind of humor that bites had best be avoided It was good nature that led Thackeray to make a very witty remark to a political opponent in an election "May the best man win!" his rival said 'Oh I hope not" Thackeray replied The wit that it is wisest for all of us to cultivate is the wit for which Mlle de Lespinasse, a famous French hostess is remembered—that of saying to each person what was suited to him

There you have the secret of a good conversationist's success He thinks about his hearers He has a warm heart as well as a clear head Instead of parading himself, he tries to build a bridge of friendliness between himself and others Such a person may lack the brilliance to become a famous talker, but he will be popular in any circle

To get others to talk well is a high art A C Benson tells in his essay on 'Conversation' how his mother did this When she was with people, she showed them at once that she cared what they thought and wanted to know what they were really like "People became suddenly interested in themselves," her son adds 'because of the charm of finding themselves so interesting to her" This kind of social unselfishness is at bottom good breeding Courtesy is the basis of good conversation, as it is of all attractive behavior

Important Factors in Conversation

"He laughed like the screech of a rusty hinge," James Whitcomb Riley said of one of the "Nine Little

Goblins" when he wanted to indicate how frightful the creature was. Most people are repelled at once by a harsh, loud, or shrill voice, just as they are charmed by a gentle, low-pitched, mellow one.

Lazy jaws that open only far enough to let out a few stifled sounds cause some of the blurry voices you hear. Straight, tight lips give the voice a flat, metallic sound. It is easy to learn to round the lips in speaking and so to avoid such cramping of the vowels as "fer yer," "jist," and "wuz."

A good voice must have the help of good speech, whose twin handmaidens are clear enunciation and correct pronunciation. Poor enunciation—jumbling words together, racing them off the lips, or drawling them out boresomely—suggests lack of self-respect and thought for one's listeners. "Cantcher," "'M gonna see'uh moom pitcher," "C'lina," "runnin'," and "pepperation" (for preparation) are instances of the slovenly enunciation that mar conversation.

Are You Sure of Your Pronunciations?

Pronunciation is settled by usage and recorded in dictionaries. It is well to check up now and then on old words as well as to look up new ones and any words you hear given a different pronunciation from your own. Even common mispronunciations like "longjeray" for lingerie and "raddiator" for radiator are not excusable.

One of the best ways to improve your conversation is to be accurate in word use. Interesting, effective talkers avoid such common errors as "party" for one person, "aggravating" for provoking, and "balance" for rest or remainder. The worst word-abusers, though, are those who work a few words so hard that they cease to have any meaning left. How many times a day do you use "awful," "nice," "grand," and "terrible"? Do you ever think what the words really mean? A slang expression that just fits an occasion and is not stale may enliven talk, but we suspect a dull or sleepy mind when someone habitually responds, like a mechanical doll, with "Yeah?"; "You're telling me!"; "So what?"; "That's swell"; or "Okey doke." Increase your vocabulary, and you will not be tempted to use hackneyed and tasteless expressions. Reading, listening to people who talk well, and noting down and looking up new words will give you a command of speech that will serve you well. And so will observance of the rules for good English. Conspicuous grammatical mistakes are to a speaker's personality what dirt spots are to a shirt or dress. (*See* Grammar; Slang.)

What to Talk About

"What shall I talk about?" is a question that perplexes many. The best rule is to think about the possible interests of the person or persons with you and not fret about the topic. Or speak of something that interests you. Concern yourself with making your companion feel comfortable; the subject does not matter much. A good way to get a conversation started is to think back to what your companion was talking about or doing when you saw him or her last, and take that as your lead. "Did you enjoy the trip to Minnehaha Falls?" "Have you finished your airplane model?"

Once a conversation is launched, it is give and take. Each person talks a little, then listens as another takes his turn. You may not care about building airplane models, but you can get pleasure from a friend's enthusiasm as he tells of constructing one. Presently a subject you both like will come up, and your exchange of ideas will kindle new thoughts. And you can always learn something that will entertain or profit you if you get another to talk his best.

Courtesies and Bad Manners

The highest courtesy we can pay a speaker is to listen attentively and respond politely. A compliment that always pleases is to ask a person to continue after an interruption—"What were you going to say?" "Won't you finish your story now?" Other conversational courtesies are these: changing the subject if it appears not to interest others or they have tired of it; avoiding any exchange of looks or mention of a subject that may embarrass someone present; readiness to laugh at others' jests; and speaking to any one who seems to be left out of the talk.

"Aw, you never," or "I don't believe it," you may have heard an ill-mannered boy say after a story was finished. Rude, we all agree. But so is correcting a speaker for some small inaccuracy. "It took us five hours to get there," a hiker says. "No, you mean five and a half," a comrade prompts him, though the precise time does not matter. Another discourtesy is asking questions people may not want to answer: "What did that cost?" "Doesn't your father live at home?" "What grade did you make?"

How to Differ Without Quarreling

Differences of opinion help to make conversation lively, but quarrelsomeness is ill-bred; and even quietly arguing your point too long is poor taste. Taking offense at a person who holds a different opinion from yours is childish. In his 'Autobiography', Benjamin Franklin tells how he improved his contacts by learning to be tolerant of others' opinions:

> When another asserted something that I thought an error, I denied myself the pleasure of contradicting him abruptly . . . and in answering I began by observing that in certain cases or circumstances his opinion would be right, but in the present case there appeared or seemed to me some difference. I soon found the advantage of this change in my manner.

Talk with Strangers

In a story by Ruth Suckow called 'The Little Girl from Town', there is an account of the way in which some boys and girls on a farm made a strange little girl from the city feel at home.

> "Do you want to come into the yard, Patricia. You do, don't you?" Leone (the eldest) asked coaxingly.
> Patricia went soberly with her. . . .
> "Do you want to see our dolls, Patricia?"
> So far Patricia had been consenting but silent. . . . "I'll bet you have nice dolls at home, haven't you, Patricia . . . lots nicer dolls than we have?"
> Patricia spoke for the first time. "I have fifteen dolls."

Then her hosts began asking about the dolls' names; the ice was broken, and everyone had a good time.

Cultivate this attitude of good will toward new acquaintances, and you can outgrow shyness. Think of meeting a stranger as a chance to have a good time,

to make a friend, and to be one Look with a smile directly into the other's eyes when you are introduced, and shake hands with a firm, friendly clasp This good start will give you confidence Don't feel that you must be in a hurry to say something (you may politely wait for an older person to open the conversation), but don't hold back, hoping to think of something important to say Say what comes into your mind, its naturalness may put you both at ease Above all, don't drop your head or gaze at the floor as if you had something to be ashamed of Hold your head and chest up, and you will feel more assurance

FINAL WORD OF ADVICE

If we were to assemble a few precepts on conversation they might be these

Like people and learn to be interested in them, be kind, sympathetic, and sincere

Observe your listeners facial and bodily expressions to see how they are taking what you say

Talk with people and not to them

Try to keep the conversation within the understanding and enjoyment of everyone taking part

Read books and study people, cultivate broad interests and keep yourself well informed

Try to see things for yourself, as if you had never heard what anyone else thought or said about them

Don t be too serious, enjoy the little incidents of every day as well as the big occasional events

These principles are consciously or unconsciously followed by the people who are good conversationists and are said to have charm and personality

Small Talk

When friends have but a few minutes together, when strangers meet, when a group first assembles, the conversation is of the light, shifting kind which we call "small talk " For example, when two friends meet

"Where have you been lately? I missed you at the Omega dance "

"That makes me feel worse not to have been there I was at my cousin s in Danville I hear you ve been chosen for the Washington High debating team Congratulations! "

And so on When two without a common background meet, they are likely to take a cue from what is happening at the moment At a picnic, described in Little Women', Amy and Grace were thrown together. One of the boys rode up on a horse ' to display his equestrian skill before the young ladies "

' Don t you love to ride? asked Grace of Amy

I dote upon it my sister Meg used to ride but we don t keep any horses now except Ellen Tree added Amy laughing

Tell me about Ellen Tree, is it a donkey? asked Grace, curiously

In such conversations, talk flits from one topic to another without anyone s caring what direction it takes It may be very delightful, nevertheless, and produce an atmosphere of warmth and good feeling

Business Conversations

Unlike a social conversation the primary purpose of a business interview is not entertainment But the same principles apply to both All you know about conversation will help you when you seek a position, for instance, or try to make a sale

Before an interview, go over the facts you may need to use Imagine the questions you may be asked and have clear, decisive answers ready Think about the needs of the person you are to see If possible, find out something about him, so that you may know better how to suit your remarks to him If the prospective employer or buyer shows signs of boredom, switch to another subject or leave In any event, do not stay too long, for, as the visitor, it is your place to make the move to go Whether the interview has been successful or not, let the parting be pleasant—"Thank you for seeing me, good-by" or something else that is courteous and good tempered

At the Telephone

When one has given his name over the telephone, it is pleasant to be greeted by a voice with a welcome in it, not with a flat, impatient "Yes? ' The caller is the one to end the conversation, except when a man calls a girl, then he lets her give some indication that she has nothing more to say, such as ' I ll see you Friday then," before he says "Good by "

Avoid making calls at meal times. If you find that you have called during dinner say you will call later Never begin with ' Who is this? ' Ask for the person you want, or you can say, ' Is this Marion? ' Only the very inexperienced say, ' Guess who this is " (Other useful suggestions about conversation will be found in the article Etiquette)

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COOK, CAPT JAMES (1728–1779) The English navigator Capt James Cook was the ideal type of bold explorer Caring little for reward, he started out on his long voyages prompted by a love of adventure and a curiosity about distant lands and their people He brought to his task a knowledge of mathematics and marine surveying He was also a practical physician who kept his sailors free from the dreaded scurvy by feeding them sauerkraut His men loved him for his kindness and admired him for his courage

James Cook was born at Marton a village in Yorkshire England, in 1728 His father was a farmer James was apprenticed at 12 to a haberdasher and later to a shipowner In 1755 having risen to be a mate, he joined the royal navy Four years later, as master of the ship *Mercury*, he took part in expeditions against the French in the St Lawrence River His skill in sounding surveying, and charting this river won for him the post of marine surveyor of the coasts of Newfoundland and Labrador He published books of sailing directions that showed remarkable abilities He also won a reputation as astronomer

and mathematician by his account of a solar eclipse off the coast of North America.

In 1768 Cook was put in command of the *Endeavour*, of 370 tons, to observe a transit of the planet Venus in the South Pacific. He spent six months circumnavigating and mapping the coasts of New Zealand, but was unable to explore the interior because of the hostility of the natives. From New Zealand he proceeded to the east coast of Australia. This coast proved much more inviting than the west coast, which had been visited earlier by Dutch navigators (*see* Australia). Cook named the east coast New South Wales because he thought it resembled the south coast of Wales in Britain. The naturalists who accompanied him named a bay, near the present site of Sydney, Botany Bay, because of the richness of its vegetation. After exploring the coast of New Guinea, Cook returned to England in 1771.

Cook's second voyage (1772–75) was undertaken to prove or disprove the common belief that there was a great continent in the southern Pacific Ocean, to the southeast of Australia. He crossed the Antarctic Circle—he was the first European to do this—but did not go far enough south to discover the real Antarctic continent, which was not reached until long after his day. From west to east he explored the entire far southern Pacific, mapping known islands and discovering several new ones. The maps he made of this region differ little in their main outlines from those in use today. When he returned to England, he was awarded the Copley medal for his success in preventing scurvy, which up to this time had caused a heavy loss of life on prolonged voyages.

At 48 Cook was still eager for adventure. In 1776 he set out on his third voyage to settle the old question of a possible sea-passage across America or around it to the north—the so-called Northwest Passage. On this voyage he came upon the Hawaiian Islands, which had been discovered earlier by the Spanish but later forgotten. Cook named the group the Sandwich Islands in honor of the Earl of Sandwich, first lord of the Admiralty.

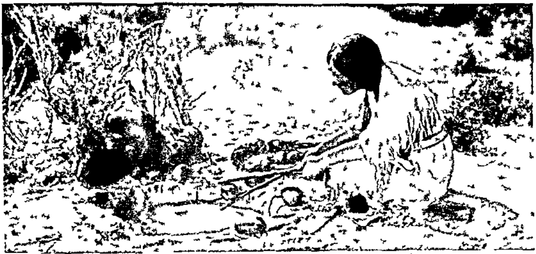
Cook made extensive explorations of the northwest coast of North America, seeking an inlet. Beyond Bering Strait he found ice stretching as far as the eye could reach. Forced to turn back, he returned to Hawaii to winter. He had won the friendship of the natives by his usual wise and kind treatment. Trouble arose, however, when one of the ship's boats was stolen. Cook took a band of mariners ashore to recover the boat. A scuffle followed in which he was killed.

Cook had surveyed a greater length of coast line than any other man and had remade the map of the Pacific. His explorations gave to Great Britain the lands now occupied by two self-governing members of the Commonwealth—Australia and New Zealand.

CAPTAIN COOK, LAST OF THE GREAT EXPLORERS

At the left, we see Captain Cook with one of the many maps he made on his voyages. When he had finished charting the South Pacific Ocean, the map of the world was virtually complete. The picture above shows the bold explorer a moment before his death. He had landed with some of his men in one of the bays of the island of Hawaii to recover a boat that had been stolen the night before. A fight began, and when Captain Cook turned to signal his ship for reinforcements he was stabbed in the back by a Hawaiian warrior.

COOKING, *an Important* ART *of* CIVILIZATION



Since they had no metal pots Indians boiled water for cooking by dropping hot stones into a skin lined pit as you see this Blackfoot woman doing This is a photograph of a model in the American Museum of Natural History

COOKING The art of cooking is almost as old as human hunger As soon as men had fire the accident of leaving a haunch of meat near the blaze must have taught them how much better meat tastes when cooked

Even primitive peoples such as the American Indians knew almost every form of cooking that we use today The only ways of cooking are by roasting broiling baking frying boiling or stewing steaming parching and drying or a combination of some of these The Indians knew all these except perhaps frying But of course since they had no metal their cooking utensils and their means of controlling fire were much cruder than we have today

How the Indians Cooked

We often speak of roasting meat when we should say baking Properly speaking when you roast meat you hang a thick piece of it before an open fire Broiled meat is cut in strips or slices and held over the open fire on either a spit or a grid The Indians put small pieces of meat on the end of sticks and stuck one end of the stick into the ground while the meat dangled on the other end over the fire or they slid the meat along to the middle of the stick and thrust both ends into the ground one on each side of the fire They also made grids of wood much like the iron grids we use today when we go camping

Baking means cooking food in an oven by indirect heat from its walls If you have ever attended a clam bake you know one method of baking used by the Indians There were several variations but in general they dug a pit lined it with stones and built a fire in it When the fire died down they raked out the ashes Then they wrapped the food in leaves or corn husks placed it on the hot stones perhaps added more hot stones and then covered the top of the pit with more leaves and earth or with old matting to hold in the heat Sometimes they poured in water to make steam When they opened the pit they found the food deliciously baked in its own steamy juice

Another very good idea of the Indians for baking food can be used today when you are camping They wrapped up fish or meat or any kind of food in leaves or cornhusks then smeared it all over with clay and placed it in hot embers or ashes When it was cooked they carefully broke off the clay and leaves and there was the well cooked food with none of its flavory nourishing juices lost

When we speak of frying we mean cooking in a pan containing more or less fat The nearest that primitive people came to frying was to place food on a flat stone over a fire The result was more like parching or baking

Boiling Without Metal Pots

Of course the Indians had a hard time boiling food because they had no metal pots Some tribes dug a small hole in the earth lined it with a buffalo skin or the stomach of a buffalo put water and meat in the kettle thus formed and dropped in hot stones until the water had boiled long enough to cook the meat Others made a tripod of logs hung the buffalo stomach down like a kettle over the fire and managed to boil food before the tripe itself became too tender to withstand the fire Other Indians made kettles of birch bark or pine bark or of big gourds or clay and dropped in hot stones

The Zuñi Indians steamed food by making a sieve of yucca fibers or sticks and setting it over a pot of boiling water Some of the pottery made by the Indians was of clay that became so hard that it could be set directly on the fire Such pots are still made and used for cooking in certain pueblos today

Parched corn was much used by the Indians when traveling. Some tribes parched it in pots over the fire, stirring it to prevent burning. Others held it in baskets over the embers; they had to be very deft to parch the corn without burning the basket.

Many primitive peoples are adept at drying foods. Jerked meat and pemmican, made from dried meat pounded and mixed with fat and sometimes with pounded choke-cherries, were staples among the Plains Indians.

How very hard the Indians had to work in order to cook their food with these primitive pots and baskets! They must have felt that cooking was very necessary and important, to spend such effort on it.

Importance of Cooking

They were quite right. Cooking not only makes our food taste better, but it causes changes in the food which make it digest better. Also, the heat kills bacteria and parasites which might harm us. While a certain amount of raw food is good for us, our health and our pleasure at mealtime depend on the very important art of cooking.

Primitive peoples were used to monotony in their foods as well as a low standard in their preparation. But cooks today are expected to provide us with a wide variety of attractive and wholesome dishes. To make their task easier, they have at their command fine modern stoves, toasters, refrigerators, fireless cookers, roasters, knives, choppers, and other equipment in an almost endless array. In the market they find many varieties of foods brought from distant parts of the earth. Science aids them with information about the nature of the various foods and what happens to them in the processes of cooking. Schools teach them how to add to foods the many values we expect.

The home cook deals with foods in a number of ways not expected of the professional cook and so has opportunities for adding more of these values. She must plan menus which will nourish her family and at the same time humor their likes and dislikes; she usually must buy the foodstuffs herself and see that they are wholesome and properly priced; she must know how to prepare various pleasing dishes and how to serve them so that the family enjoys the hours spent at the table. The professional cook, on the other hand, usually is concerned only with the actual cooking of foods in large quantities; specialists do the planning, the buying, and the serving.

What a Cook Must Know

To cook well, the home cook must have training. She must know something of the chemistry of foods, what happens to them when they are cooked, and how to control her cooking. She must be exact and deft in handling batters and doughs, in paring, mashing, basting, and so on. She must know the importance and methods of measuring ingredients accurately. And she must know good food when she sees it, smells it, and tastes it. No one can cook well whose eyes and palate cannot tell the difference between light, fluffy mashed potato and a soggy, lumpy mass; between a dainty, tender cake and a heavy one; between an egg gently fried and one turned into leather.

A good cook must not only be expert in planning, cooking, and serving foods; she must also know how to care for foods properly, to keep them fresh and clean. A good cook understands that bacteria and mold spores, which are always in the air, settle upon exposed foods. She knows that these micro-organisms thrive in moist, dark, and warm places and that foods therefore will keep better in places that are cold, light, and dry. She keeps her kitchen, her cooking equipment, and herself spotless so that there will be no breeding places for bacteria and molds that might be passed on to foods. She knows that disease germs may be carried to our foods by the water in which they were grown or washed, and that poisonous sprays are used on many fruits and vegetables to keep down insect pests. Hence she is careful to wash fruits and vegetables thoroughly, especially if they are to be eaten raw. She is also careful to protect foods from flies and roaches and other germ-carrying pests.

Providing Variety

Probably the easiest task of the home cook is to provide variety. Refrigerator cars or fast freights and ships bring us pineapples, oranges, bananas, grapes, berries, meats, milk, butter, eggs, asparagus, lettuce, and hosts of other delicious and perishable foods throughout the year. Beef may be had far from the cattle range, and fish far from the sea. With the great variety of climate in the United States, no food is for a long period "out of season"; and in any case most fruits and vegetables and many other foods may be bought in cans or in dried form.

All these many foods may be cooked in varied ways. Meat may be broiled, baked, roasted, fried in deep fat, or stewed. Vegetables may appear in salads, soups, garnishes, or special dishes. Milk may be used as a simple or fancy beverage, or in cream soup, ice-cream, sauces, and junket. Ingenious cooks have compiled thousands of recipes for enjoyable dishes.

Planning Attractive and Well-Balanced Meals

Menu planning is just as important as cooking. Foods properly combined are more interesting and offer a better balanced diet. We enjoy contrast in foods—contrast in texture, temperature, color, and flavor. For example, we like to eat crisp salad with a smooth, mashed vegetable; crunchy toast with soft-boiled egg. We like hot meat with cold salad or sherbet, or ice-cream with hot chocolate sauce. We like red tomato on green lettuce, orange-colored carrot with pale chopped cabbage, white frosting on brown cake, a red cherry on white pudding, yellow peaches with green grapes. We like the bland with the pungent, lemon juice squeezed on baked fish, fruit sauce on bland pudding, fruit with cereal, apple sauce with pork, cream cheese with bar-le-duc. To build a good menu you must genuinely enjoy and appreciate good food.

Variety in food is valuable not only because it adds enjoyment to meals but because, by eating a wide variety of foods, we are more likely to get all the

various vitamins and other food elements necessary for health and growth We must have proteins fats, starches, sugar, minerals, and the vitamins in sufficient amounts, and our menu must supply us with enough calories to maintain our energies (*see* Food) A well balanced menu of well cooked food makes us want to eat a bit of everything on the table and so we get all the food elements necessary for good health If only one or two dishes attract us, we become finicky eaters and do not eat well balanced meals

Food must be cooked so that its nutritional value is not destroyed Meat for instance, should be cooked at a low enough temperature to make it tender The tough fibers of cereals must be softened by long and thorough cooking so that they may be completely digested Vegetables must be cooked so as to retain their valuable minerals and vitamins If these are thrown out in the cooking water, considerable food value will be lost

Making food attractive is just as vital as cooking it to retain its food values The roast should send out a delicious smell the baked fish should be done to just the right shade of brown sprinkled with parsley, and bedecked with a garnish of lemon or radishes The time of year and the weather should be considered In hot weather we shudder at roast pork and baked macaroni, but enjoy cold jellied consommé, cold meats, crisp fruit and vegetable salads and iced desserts and drinks Dishes do not need to be all fussed up" in order to look attractive A dab of whipped cream in the soup, a bit of jelly on the pudding, a cherry on the ice cream a flick of paprika, chopped parsley, or grated cheese in the right spot, will add attractive appearance and zest to simple dishes at small cost of time or money

Keeping Down Food Costs

Cost is something that most home cooks have to think about in preparing a meal A cook who shops cleverly and makes intelligent use of leftovers can keep down food costs She need not buy a fancy cut of meat for soups or stews or for meat loaves or other chopped meat dishes Apples not pretty enough to put into the fruit dish in the center of the table may be good enough for sauce or salad If vegetables are fresh and well grown, they need not be perfect in shape to be used in soups and salads A home-cooked meal costs less so we think than the same meal in a restaurant This is because no allowance is made for paying the housewife for the time she spends in cooking setting the table or washing the dishes. In any case, whether or not it is cheaper a home-cooked meal "hits the spot because the one who prepares it usually takes the trouble to provide something we specially like on the day we happen to want it

HOW SCIENCE HAS HELPED THE MODERN COOK

Contrast this sanitary and well planned kitchen with that of the Blackfoot Indian cook on a previous page Here electricity provides clean, convenient heat Glass brick walls and enameled surfaces spread light everywhere and are readily washed Cupboards drawers and working space are generous A thermostat for regulating oven heat takes the guesswork out of roasting and baking

Cooking Proteins

When we cook meat, we must think of its protein content, its tough connective tissue, and its juices Since protein toughens in high temperature, meat should be cooked with low heat except for a brief moment of searing if that is required The connective tissue in tougher cuts must be cooked a long time The cook must consider what she is trying to do with meat and adjust her methods accordingly If she is preparing a roast for the oven, she should first sear it in a high temperature for a short time, thus closing the outlets through which juice may escape Thin loin steaks may require no more cooking than searing in a pan or over an open fire In making soup however, we wish to have the meat juices seep out into the liquid Therefore we put the meat to cook in cold water, bring it to a boil slowly, and let it simmer a long time

Eggs milk and cheese are other protein foods like meat and they, too react badly to high temperatures Eggs toughen and curdle, cheese becomes stringy, milk scorches very easily, since it contains sugar as well as protein

How to Cook Vegetables

Vegetables should be cooked so as to preserve their attractive colors, fresh flavors and food values Such vegetables as can be digested raw are best used in salads

When vegetables are cooked in a large quantity of water, the minerals and vitamins pass into the water. The more the water and the longer the cooking the greater the loss Vitamin C is destroyed by long cooking The basic rule for cooking vegetables, ex-

cept when making soup, is to cook them in as little water and for as short a time as possible. Baking vegetables, either in their skins or in casseroles, preserves all their values.

To a few vegetables this basic rule does not apply. Cabbage and other strong-flavored vegetables should be cooked in a large amount of water, boiling rapidly, without a lid. If a lid is used, the volatile oils which contain the bitter flavor are condensed on it, drip back into the kettle, and, in cabbage, cause a second chemical change which is harmful to digestion. Cabbage has achieved its bad name simply through poor cooking.

The well-equipped cook is versatile and resourceful. She should be prepared to turn out special dishes, such as bland or liquid foods for invalids or people on a special diet. She should know how to prepare food for infants, which demands special treatment. She should also learn some good dishes for camp cooking. Most families welcome an occasional foreign dish, such as a Swedish fish salad, a platter of Italian spaghetti or ravioli, or French pastry.

Inventions That Make Cooking Easy

Inventors have given the modern cook all sorts of good equipment, such as double-boilers which protect easily scorched or curdled foods from ungentle cooking; fireless cookers which save fuel; electrical devices which turn ovens on and off at desired temperatures. The cook may sit at the dining table and prepare toast, waffles, or coffee with electric devices. She may save hours of boiling tough meat or soups by using a pressure cooker, the lid of which keeps the food in the kettle cooking under pressure and thus raises the temperature far above the usual 212 degrees Fahrenheit at which water boils at sea level.

A few modern devices are not time savers but rather incentives to spend more time in making elaborate dishes. It takes time to use special cutters to make vegetable curlicues, pastry bags for decorating cakes, and fancy molds for gelatin. Such utensils are chiefly desirable when preparing a "party" meal.

When buying kitchen equipment, the cook must consider her own special needs, and whether the article will really save time and effort and help her prepare food according to the rules of good cookery.

Naturally the wide subject of cookery, involving the use of various devices and the knowledge of preparation, nutritional values, prices, and combinations of foods, cannot be mastered in a day or two. Yet the people of today are entitled to benefit by all that science and industry and agriculture have to offer for making our meals interesting, safe, wholesome, varied, and delightful. The home cook who masters her art makes her work more interesting and satisfying, and safeguards and pleases her family.

PRESIDENT COOLIDGE, *a* SILENT MAN *of* ACTION

COOLIDGE, CALVIN (1872–1933). Seven times in the history of the United States a vice-president has succeeded to the presidency upon the death of his chief. One of the men so called to that high office was Calvin Coolidge, who, after the death of President Harding, became the 30th president.

CALVIN COOLIDGE

Coolidge's career had been one of almost uninterrupted public service. Born July 4, 1872, on a farm at Plymouth, Vt., he was graduated *cum laude* at Amherst College in 1895, and while there won a prize in a contest open to all the college students of the United States upon the subject of the causes of the American Revolution. He studied law with a firm of lawyers at Northampton, Mass., and was admitted to the bar at the age of 25. He held several local public offices. In 1905 he married Grace Anne Goodhue of Burlington, Vt. They had two sons, John and Calvin. Calvin died at 16 while his father was president. With characteristic economy, down to the time of his elevation to the vice-presidency Mr. and Mrs. Coolidge with their two children continued to reside in half of an unpretentious house in Northampton.

There was something about Coolidge that attracted the confidence and regard of the public, and he was elected to a long succession of offices in Massachusetts. He was mayor of Northampton, state senator, lieutenant governor, and twice governor. During all this time he continued to be an unassuming, taciturn public servant, one who said little but worked hard, shunned rather than sought publicity, and lived up to his own homely adage: "Let men in public office substitute the light that comes from the midnight oil for the limelight."

In his first term as governor he became nationally known for the firm way he handled a strike by the Boston police. After most of the police had left their posts, he summoned the state guard, declaring: "There is no right to strike against the public safety by

anybody anywhere any time ' This occurred in a period of great unrest when communistic propaganda caused uneasiness and Governor Coolidge s courageous stand caught the popular fancy He was re-elected governor and in 19?0 was nominated for the vice-presidency by the Republicans as the running mate of Warren G Harding

As vice-president Coolidge continued to be self effacing and silent His inaugural address was the shortest on record containing less than 500 words By invitation of President Harding he sat in cabinet meetings and thus acquired a knowledge of national affairs and how they were conducted This knowledge was presently to prove of great assistance both to him and to the country

COOLIDGE S ADMINISTRATIONS
1923–1929

Public Debt and Income Tax greatly reduced
Prosecution of Teapot Dome Oil Scandals
B ll reducing Immigration passed (1924)
Soldiers Bonus Bill passed over Presidential Veto (1924)
Senate votes adherence to the World Court but with reservations unacceptable to Court (1926)
Agreements reached for funding of Foreign Debts due United States (1926)
McNary Haugen Bill for Farm Relief vetoed by President (1927)
Marines sent to Nicaragua (1927)
Coolidge Naval D sarmament Conference at Geneva fails (1927)
Mississippi Flood drives 700 000 from their homes (1927)
Kellogg Briand Treaty (Pact of Paris ' denouncing war) signed (1928)
Relations with Mexico improved

Dramatic Inauguration

In the middle of the night of Aug 2–3 1923 there came to the Plymouth Vt , home where the vice-president and his family were visiting Calvin s father John Coolidge the startling information that President Harding had died in San Francisco By the light of an oil lamp and in the presence of a few persons Calvin Coolidge took the oath of office from his father who was a notary public and announced that he would continue his predecessor s policies and retain his cabinet

The task before him was not an easy one Obedience to the leadership of a president who has attained his place through death is usually yielded grudgingly and furthermore the public presently became aware of certain scandals connected with his predecessor s administration The revelations of the Teapot Dome and Elk Hills oil leases brought about the resignations of two cabinet members Coolidge had inherited from the Harding régime and the conviction of a third cabinet secretary The oil lands were restored to the nat on

In various matters Congress showed itself unsympathetic to the president s leadership rejecting some measures which he favored and enacting others he opposed The Senate long delayed action upon his recommendation that the United States join the World Court It was not until January 1926 that a final vote was obtained and then the adherence of the nation was hedged about with reservations that proved unacceptable to other nations Coolidge continued however his quiet but unyielding insistence on the policies he believed to be vitally important Foremost among these policies was economy in governmental expenditures In this he succeeded to such an extent that the public debt was reduced at an average rate of a billion dollars a year while at the same time federal taxation was lowered despite the passage of a Soldiers Bonus bill over his veto

His Popularity Grows

In the course of his administration President Coolidge became increasingly popular with the American people Even his negative qualities such as his silence and his economy came to be regarded as virtues So in 1924 at the national convention of the Republicans in Cleveland he was nominated for the presidency with slight opposition Charles G Dawes of Illinois former director of the budget was the nominee for the vice-presidency

At the Democratic convention held in New York City a bitter fight developed between the followers of ex Secretary of the Treasury McAdoo dry and Protestant and Governor Alfred E Smith of New York wet and Roman Catholic Finally on the 103rd ballot the convention nominated for president John W Davis of West Virginia a former ambassador to England and Gov Charles W Bryan of Nebraska brother of William Jennings Bryan for the vice-presidency Groups of insurgents put forward Senator Robert M La Follette of Wisconsin and Senator Burton K Wheeler of Montana as the candidates of a new Progressive party

In the election Coolidge received 382 electoral votes to 136 for Davis and a popular plurality of over seven millions La Follette received only 13 electoral votes

Few periods in United States history have been so quiet as the last four years of Coolidge s presidency

Domestic affairs moved smoothly although there was an increasing opposition to prohibition Unprecedented interest developed in aviation partly as a result of a deliberate campaign designed to make Americans air minded The around the world flight of three United States army airplanes that of Lindbergh across the Atlantic that of Byrd to the North Pole and various other feats by daring airmen attracted universal attention

A momentous event in foreign relations had been the passage in 1924 of an immigration bill drastically limiting immigration and excluding aliens ineligible to citizenship The latter provision was aimed at the Japanese and caused much ill feeling in Japan President Coolidge criticised it as unnecessary and

offensive to a friendly people, but he signed the bill. There was much friction with Mexico over oil and land laws which threatened the interests of Americans, but President Coolidge's appointment of Dwight W. Morrow as ambassador did much to restore harmonious relationships between the United States and Mexico.

President Coolidge found it necessary to send marines to Nicaragua to restore peace and preserve American rights. The killing and wounding of a number of the marines brought a storm of criticism on the administration, both at home and abroad.

Though unable to secure adherence to the World Court, President Coolidge continued his efforts in behalf of international good will. He invited the leading naval powers to a conference at Geneva in the summer of 1927, hoping to extend the battleship ratio, agreed to at the Washington Conference, to smaller naval craft. Only Great Britain and Japan accepted, and an agreement was not reached.

Arranged Pact of Paris

The administration later scored a genuine international triumph in the negotiation of the Kellogg-Briand multilateral treaty. By this nearly all the nations pledged themselves to renounce war as an instrument of international policy. Representatives of 15 nations signed this epochal document ("the Pact of Paris") at Paris on Aug. 27, 1928, and other nations gave their adherence later.

During these years, the question of farm relief continued to be one of the most difficult problems of the government. Some branches of agriculture enjoyed prosperity, but the industry as a whole languished. Various relief measures were proposed. The one that attracted the most attention was embodied in the McNary-Haugen bill, a feature of which was designed to enable the farmer to maintain prices at home by marketing surpluses abroad at whatever they would bring. President Coolidge vetoed the bill as economically unsound.

The country as a whole, however, enjoyed unusual prosperity, and this tended to heighten Coolidge's influence and popularity. As the time for a new election approached there was considerable agitation to renominate him for another term. But on Aug. 2, 1927, the fourth anniversary of his accession to the presidency, he dramatically announced: "I do not choose to run for president in 1928." He stood by this declaration, and unobtrusively but effectively threw his influence to the support of the candidacy of Herbert Hoover.

At the end of his term as president, Coolidge returned to his home in Northampton, Mass., with a notable record of sound and efficient administration. He resumed the practice of law, became a director of a great insurance organization, and contributed articles regularly to magazines and newspapers.

JAMES FENIMORE COOPER

His thrilling tales of forest and sea, of Indians, pioneers, and hardy seamen, make him a favorite author of the American boy.

COOPER, JAMES FENIMORE (1789–1851). The first American novelist to achieve world-wide fame was James Fenimore Cooper. His stories were translated into foreign languages as soon as they came from the press. R. L. Stevenson called him "Cooper of the wood and wave," because he wrote about Indians and pioneers in the forest, and about sailors on the high seas.

Cooper was born at Burlington, N. J., in 1789. When he was a year old the family moved to a large estate on the shores of Otsego Lake, N. Y. Here the father, William Cooper, laid out the village of Cooperstown. The region was still a wilderness. Every day Indians came to trade at the settlement.

In 1803 Cooper went to Yale. He neglected his studies to spend most of his time out of doors, and was expelled after three years. He went to sea for five years, first as a merchant sailor, then as a midshipman in the navy. In 1811 he married and went to live at his wife's home in Westchester County, N. Y. In 1833, after spending years traveling abroad, he settled on his estate in Cooperstown.

Cooper's first novel, 'Precaution' (1820), was a story of English society life. It was a complete failure. The next year he turned to the American scene and won instant popularity with 'The Spy'. Harvey Birch, the hero, is one of Cooper's immortal characters. In 1823 Cooper wrote 'The Pioneers', the first of five 'Leatherstocking Tales'. The intrepid scout Leatherstocking (sometimes called Natty Bumppo or Hawkeye) figures in all these stories. Cooper described him as "a philosopher of the wilderness, simple-minded, faithful, utterly without fear, and yet prudent." Another famous character is Long Tom Coffin, hero of the superb sea story 'The Pilot'. With 'The Last of the Mohicans' Cooper reached the height of his fame. The "last Mohican" is the noble Uncas. Cooper's style was rather careless; but his swift-moving narrative is still hard to surpass.

The historical novels in the 'Leatherstocking' series should be read in this order: 'The Deerslayer' (1841), 'The Pathfinder' (1840), 'The Last of the Mohicans' (1826), 'The Pioneers' (1823), and 'The Prairie' (1827). The most popular sea stories are 'The Pilot' (1823) and 'The Red Rover' (18[illegible]). 'The Spy' (1821) is about Revolutionary times.

COÖPERATIVES *and How They* HAVE GROWN

COOPERATIVE SOCIETIES When people join together to buy goods for their own use they form a consumers' coöperative society or association When workers organize to sell what they produce they have a producers coöperative society When farmers join together to sell what they raise they have a marketing coöperative association If they buy farm supplies such as seed, feed and fertilizer they have a farm purchasing cooperative association

Today cooperatives of all sorts have organizations in 45 countries and the organizations report having 180 000 000 members This world wide movement grew everywhere from much the same desire The members wanted to adjust the difference in price between producers and consumers with the greatest advantage to themselves Members of producer cooperatives wanted to get a good price for their markets and share in the profits after the expenses of marketing were paid Members of consumer cooperatives wanted to reduce the cost of what they bought either directly or by sharing in the profits after paying the full market price

Simple Examples of Cooperatives

Each type of coöperative can be illustrated with a simple example Suppose some consumers want to cut the cost of their food by opening a grocery store Usually a number of persons get together and discuss the need of such a store before they take any action If enough people want to start a business they usually form a corporation under state or federal laws They sell shares of stock to raise capital and each member becomes part owner of the store He has a single vote no matter how many shares he buys The members elect officers and hire a manager to do the buying and selling for the group The store sells groceries at the same prices that other stores do But profits are paid back to members in proportion to their purchases These payments are called *patronage refunds*

A common type of marketing cooperative is formed by farmers to market their products Dairy cooperatives exist almost everywhere in the United States to sell milk and dairy products to consumers After the cooperative has paid all expenses, including the market rate for farmer s milk, it divides its profits among the members

Workers sometimes form producers cooperatives to market things they make in their own factories These coöperatives have never been very successful There are almost none of them in the United States

Distinguishing Features of a Cooperative

So far we have seen little to distinguish either type of cooperative from an ordinary business corporation. People do not have to form a coöperative in order to share in the profits of a store Many department stores and chains of stores offer their stock through stock exchanges Anyone who so desires can share in the profits by buying stock Likewise, anyone who thinks that marketing milk is a profitable business can buy stock in a dairy company

A cooperative can be distinguished, however, from a privately owned business by certain features. These were adopted by the first successful consumers' cooperative They are called the *Rochdale principles*

The Rochdale Store and Its Principles

The first successful consumers cooperative was started in Rochdale England, in 1844 Twenty-eight poor weavers saved $140 for the purpose and they formed the Rochdale Society of Equitable Pioneers They adopted principles which proved successful, and have served as guides for cooperatives ever since The important principles are

1 Each member has only one vote regardless of how many shares he owns Anyone who wishes may join

2 Goods and services are sold at market prices After all expenses for running the business have been paid the profits are returned to the members in proportion to their purchases in the form of a patronage refund

3 Return on invested capital is limited

Another Rochdale practise which is generally followed is to sell for cash This avoids many losses from bad credit Most cooperative associations also carry on a continuous program of education Religious and political neutrality is generally observed

The most important distinguishing feature is the first principle about voting In a private company, owners vote according to the amount of stock they own If one man owns a majority of all the stock, he has complete control In a cooperative, each member has an equal voice

Advantages and Weaknesses of Coöperatives

This ownership principle prevents many abuses which grew up when large-scale business corporations were taking shape in the 19th century When control can be secured by purchasing stock strong financial interests could consolidate many companies, build monopolies, and then operate to obtain the interest profit with little regard for other interests A coöperative must always be run for the benefit of all its members because each of them has an equal vote in the management

On the other hand, a cooperative must be run as efficiently as a private business If the members mistakenly force the management into unwise policies such as pricing consumer goods too low or failing to give satisfactory service in marketing the members products the cooperative will fail Good management and good business judgment are as important in a *cooperative as in any other enterprise*

Marketing Associations

The greatest use of cooperative associations in the United States today is made by farmers In the *marketing cooperatives*, farmers join together to market what they grow Many of these groups began in pioneer days when farmers worked together in driving their livestock to city markets Others grew up later to give the farmer a better return from marketing his produce

Marketing cooperatives aim to sell the products of its members at prices that will give the farmer

as good an income as possible. They operate on several different plans, but almost always the coöperative acts as the sales agent of the farmer. As they grow, marketing cooperatives often take over the preparation, packing, grading, shipping, advertising, and wholesaling of their products.

Within the past 20 years, farm supply *purchasing* coöperatives have grown rapidly. They buy seed, fertilizer, petroleum products, farm machines, and other equipment and supplies for their members.

More than 19,000 farmer-owned and farmer-controlled cooperative associations and mutual companies now operate in the United States. Of this number, 10,150 are engaged in marketing and purchasing farm production supplies. There are also 4,400 mutual irrigation companies, 1,900 mutual insurance companies, 2,000 farmers' mutual telephone companies, 1,000 rural electric coöperatives, and 600 coöperative frozen-locker plants.

About two-thirds of America's six million farmers belong to one or more coöperative associations. In 1944–45 the 10,150 farmer coöperative marketing and purchasing associations had an estimated membership of 4,505,000. In that year marketing cooperatives did an estimated business of $4,835,000,000, while farmer purchasing cooperatives sold their members $1,095,000,000 worth of goods and services.

Coöperatives market approximately 57 per cent of the oranges, 40 per cent of the grapefruit, and 95 per cent of the lemons sold as fresh fruit in the United States. They market more than a third of the wheat crop, a third of the nation's butter, half of the city milk supply, and large quantities of cotton, tobacco, nuts, and other crops.

Consumers' Coöperatives

Consumers' coöperatives have grown rapidly in the United States, and their total membership is now estimated at about 5,000,000. This includes the members of credit unions as well as the members of retail stores and service groups. In recent years consumers' coöperatives did about one per cent of the total average retail business of the country.

Grocery stores, meat markets, general stores, and gasoline stations are the most common types of consumer coöperative stores in the United States. But almost every kind of goods is sold by some coöperative. There are coöperative bakeries, restaurants, ice and coal dealers, and stores selling books and school supplies. Electric light and power associations, telephone companies, hospitals, laundries, housing associations, publishing houses, and funeral associations are found in the list of coöperatives.

The coöperative principle has also entered the field of finance. Small-loan banks, called *credit unions*, are a rapidly growing type of coöperative activity (*see* Banks and Banking). *Mutual insurance* companies are among the strongest and oldest companies in that line of business.

Many independent businessmen have organized "retailer coöperatives" to purchase supplies for their grocery and drug stores with the advantage of large-scale buying power. The benefits go to the store owners, enabling them to compete more effectively with the large chain stores.

Wholesale Organizations

Often a number of cooperative associations maintain their own wholesale or central purchasing agency. Such wholesale organizations operate in much the same way as the coöperative retail stores, selling to members and returning savings to the member coöperatives. Some go a step farther and process some of the goods they sell in their stores. Some own factories, oil wells, canning plants, mines, and farms.

A good example in the United States is Consumers Coöperative Association of Kansas City, Mo. It is owned by nearly 1,500 affiliated local organizations, and these in turn are owned and controlled by some 250,000 members, mostly farmers. Since much of its business is in petroleum production, the coöperative has built three refineries and purchased pipe lines to carry the oil from 946 wells it also owns. Many farmer members of Consumers Coöperative Association grow vegetables, so the association has a canning plant in Scottsbluff, Neb. Many of the local associations sell groceries, so the wholesale association stocks and sells groceries of all kinds, some of them bearing the "Co-op" brand. Electrical appliances, roofing, farm machinery, and other items are handled.

Another good example is the Coöperative Wholesale Society of England. It has 150 factories and makes hosiery, corsets, shoes, shirts, furniture, motors, bicycles, china, bottles, drugs, and chemicals. It owns dairies that produce butter and cheese. It operates flour mills, printing shops, canneries, automobile works, bakeries, oil refineries, and sawmills. It owns thousands of acres of farm lands in England and Canada, and great tea plantations in India and Ceylon.

The English and Scottish wholesale societies together are the greatest single importers of tea, grain, butter, sugar, and dried fruits in the world. They are Canada's best customer for wheat, and they operate the largest flour mills in Great Britain. The English society has its own fishing fleet and sends its own steamships all over the world.

Among the biggest wholesale organizations supplying the retail consumers' associations are Midland Coöperative Wholesale, Minneapolis, Minn.; Central Coöperative Wholesale, Superior, Wis.; and Eastern Coöperative Wholesale, New York City. To obtain the advantage of large-scale buying, some of the regional wholesales have combined to form national organizations. These purchase directly from manufacturers.

"Self-Help" Coöperatives

In times of business stress, unemployed men and women may form "self-help" coöperatives. Some organizations are trading posts. The members bring in articles to trade with one another and with nonmembers. Others are labor exchanges where members trade services. A dentist may repair a cobbler's teeth, and the cobbler repairs the dentist's shoes.

Still others trade the labor of the group for some commodity. They may all pick fruits or vegetables

for a share of the crop Occasionally, simple manufacturing for use or for sale is carried on

National Organizations

The National Council of Farmer Cooperatives represents marketing and farm supply purchasing cooperatives through its headquarters in Washington, D C The American Institute of Coöperation in Washington is the educational organization for farmer coöperation in the United States

The Coöperative League of the United States of America, Chicago, Ill, serves as a clearinghouse of information for consumers' cooperatives It is affiliated with the International Cooperative Alliance, which has membership in all parts of the world

Early American Cooperatives

There are many recorded examples of farmer coöperation in the United States in the early 19th century A cooperative dairy association was organized in Connecticut in 1810 A group of Ohio livestock producers made joint shipments to market in 1820 Farmer mutual fire insurance companies can be found back in 1820, and mutual irrigation companies were founded by the Mormons in 1847 A cooperative cheese factory was established in New York State in 1851

Among the notable early attempts at cooperation in the United States were associations of laborers in the Sovereigns of Industry and industrial workers in the Knights of Labor The growth of cooperatives in the United States has been greatly influenced by organized farmers In 1867 there were 400 marketing and purchasing cooperatives in the United States Patrons of Husbandry, or National Grange—also known as the Grangers—and the Farmers' Alliance promoted cooperatives on a national scale By 1890 there were a thousand active farmers' cooperative associations The Farmers Educational and Cooperative Union of America, often known as the Farmers Union, founded in 1901, and the American Farm Bureau Federation, started in 1919, have supported and organized coöperatives

Cooperative Societies in Europe

Large as the figures for the United States appear, they are small compared with coöperative activities in other lands In Great Britain, the mother of the cooperative society, more than 8,000 000 persons belong to consumers' societies The membership includes 20 per cent of the population and represents more than half the families of the nation The annual retail trade of these societies is about 30 per cent of the total for the country

Denmark is a leader in agricultural coöperation More than half the total business of the country is carried on by cooperative societies and 20 per cent of the goods consumed are sold by coöperative stores Finland, Iceland, Switzerland, and Sweden have powerful organizations Swedish cooperatives attracted world wide interest when they broke monopolies in flour milling, rubber goods, and electric bulb manufacturing The cooperatives acquired factories and manufactured these goods for themselves Prices fell drastically This success won many new members, and these societies control 20 per cent of the wholesale and retail trade of Sweden

French cooperatives were severely hurt by the second World War but they are being revived Soviet Russia has cooperatives but they are closely controlled by the state Many American coöperative leaders do not consider them genuine cooperative organizations The cooperatives in Italy and Germany suffered greatly during the Fascist and Nazi régimes but many of them are being rebuilt The International Cooperative Alliance and the Food and Agriculture Organization of the United Nations are aiding in the reorganization

China, Japan, and India have many cooperative organizations The postwar allied military government encouraged their spread in Japan.

Arguments about Government Aid

Businessmen often object to government encouragement of cooperatives by legislation, such as the Capper Volstead Act, and exemptions of farmer cooperatives from certain taxes by the Federal Revenue Act of 1926 They accuse the Agricultural Extension Service, the Tennessee Valley Authority, the Farm Credit Administration, and other government agencies of having unduly aided cooperative enterprises The National Tax Equality Association charges that 'by law and Treasury rulings cooperatives escape payment of all or nearly all federal income taxes"

Leaders in the cooperative group reply that the nonprofit nature of their operation justifies their tax position They furthermore claim that the savings made by cooperatives do not actually belong to the cooperative at all but are rather the property and therefore the income of cooperative members It is these members who individually pay the income taxes on that money

Cooperative leaders point out that the government aids other business in suitable ways just as it aids cooperative associations They call attention to the work of the Federal Reserve System the Reconstruction Finance Corporation, the Bureau of Standards, the Department of Commerce, the United States Weather Bureau and the protective tariff as some government aids to business

Finally, cooperative leaders maintain that coöperatives cannot influence prices unduly or unfairly A coöperative must buy supplies, buy or rent land, warehouses, factories, or stores just like a private business It must pay its workers just like any business The only possible difference is in the amount added to prices for profit Many private businesses operate on a very small margin of profit and sometimes undersell cooperatives According to this view, the real test between coöperatives and private business lies in the efficiency of management, and efficient management is desirable in everybody's interest

Education Vital to the Cooperative Movement

The success of the coöperative movement depends on popular understanding as well as wide leadership and efficient management Therefore education is a vital part of the coöperative movement Coöperative

societies usually fail when their members do not fully understand their purpose.

One reason the Danish coöperatives have proved so successful is the educational program of the Danish folk schools. In England, Sweden, Finland, and every country in which they are active, the coöperative societies are closely related to the program of adult education.

COOT. This slate-colored water bird is about 15 inches long. Also called the mud hen, it is found in shallow reedy ponds and sluggish streams. The American coot is found in all parts of North America; it is migratory in the North, but resident in the South. In South America there are about six other species. The common coot of the Old World, found in Europe, Asia, and northern Africa, is black with a white bar across the wings, and a peculiar white bald spot on the forehead, which has given it the name "bald coot." Coots differ from rails chiefly in having toes edged with a scalloped membrane. (*See* Rail and Coot.)

COPENHA'GEN, DENMARK. At the gateway to the Baltic, on the easternmost shore of the island of Zealand stands Copenhagen, capital of Denmark. Twenty miles away, across The Sound, lies the coast of Sweden. In front of the city, and forming a protective wall for its harbor, stretches the small island of Amager. Because of its key position and the excellence of its harbor, Copenhagen has long been one of the great commercial ports of northern Europe.

From the city go out large quantities of the butter, eggs, and bacon produced in Denmark for foreign markets. Here also is an area set aside as a free port where goods from one foreign country may be transshipped to another without payment of duty.

The famous Copenhagen porcelain has won a worldwide reputation for its exquisite glaze and beautiful decorations, but most of Copenhagen's manufacturing industries are devoted to making goods for home consumption. The most important of these are bicycles, Diesel engines, ships, beer, and beet sugar.

Much of the charm of Copenhagen springs from its shining cleanliness and its casual mixture of the old and the new. Narrow, twisting streets open out upon wide handsome boulevards, and 16th- and 17th-century buildings, bristling with steeples, spires, and domes, stand next to modern structures of steel and concrete. The most beautiful of the boulevards is the famous Lange Linie (Long Line), which runs along The Sound. Off this drive is Amalienborg Square, in which stand the four royal palaces.

The business and commercial life of Copenhagen is centered in a section called Stroget. Here are many of the city's shops, office buildings, theaters, and museums. The places of amusement are always well filled with happy crowds. Bicycles swarm about the city to such an extent that it is easy to believe the claim that every third person owns one. Along many of the Stroget streets are flower, vegetable, and fish stands tended by shrewd country women in long, full skirts, aprons, and starched poke bonnets.

The three outstanding figures in Copenhagen's cultural history are Albert Thorvaldsen, the sculptor; Hans Christian Andersen, the beloved teller of fairy tales; and Bishop Nikolai Grundtvig, the founder of the system of folk schools. The Copenhagen University, founded in 1479, is free to all students.

The city developed from a 12th-century fishing village. Its name means "merchant's haven," but because of its strategic position its history has been stormy. In 1770 the city withstood bombardment by the combined English, Dutch, and Swedish fleets. During the battle of Copenhagen, in 1801, the Danish fleet was destroyed in the harbor by the British, in order to prevent its falling into the hands of Napoleon. In 1807 the British fleet again sailed in, shelled the city, and destroyed many of its buildings.

From 1940 to 1945 Copenhagen was occupied by the Germans. Although some of the factories were bombed by the Allies during this period of German occupation and even more were destroyed by the sabotage of the Danish "underground," the city was left in better condition than most places that had been under Nazi rule. Not long after its liberation in May 1945, it was sending food to the starving countries of Europe and going its orderly way toward normal living. Population (1950 census), 768,105.

COPERNICUS, NICOLAUS (1473–1543). Often considered the founder of modern astronomy, Nicolaus Copernicus was born in Torun, Poland, the son of a Polish merchant and his German wife. The boy was reared by his uncle, a wealthy Catholic bishop, who sent him to the University of Cracow to study mathematics. In 1497 the 25-year-old Copernicus was appointed canon of the cathedral of Frauenburg. Though never ordained, he held this position until his death.

During the next few years he traveled in Italy, studying law at Bologna and medicine at Padua. In 1500 he lectured on astronomy in Rome. He returned to his uncle's castle near Frauenburg in 1507. As attending physician to the old man, Copernicus had little freedom but spent as much time as he could studying the stars.

His study convinced him that the earth rotated on its axis and that the earth and planets revolved around the sun. This was contrary to the Ptolemaic theory then generally believed (*see* Astronomy; Ptolemy). After his uncle's death in 1512, Copernicus devoted himself with greater energy to astronomy. In 1530 he finished his great book, 'Concerning the Revolutions of the Celestial Spheres'. In this work he advanced many arguments to show that his theory explained the apparent motions of the heavenly bodies as well as the Ptolemaic theory and that, moreover, it was more logical. The Copernican theory was in opposition to the teachings of the Roman Catholic church and the book was not published for 13 years. Copernicus received the first copy as he lay on his deathbed. The book stirred up men's minds and opened the way to a truly scientific approach to astronomy. Such men as Galileo and Kepler were profoundly influenced by it (*see* Galileo; Kepler).

COPPER—*The Red* METAL *with Countless* USES

COPPER The wires that deliver electricity for *power and carry telephone messages are made of* copper So are the wires in electric motors and generators, and in radio and television sets Copper is used because, aside from costly silver, it is the best *of all metals for conducting electricity*

Copper is shaped and coated with tin *to make* cooking vessels When alloyed with zinc it makes brass, and brass is used in countless ways In most homes it is likely to be present in the works of the alarm clock, in some water faucets, in small screws, and in the eyelets of shoes

Copper was the first metal man used for tools and implements, probably because copper like gold and silver, is sometimes found in a pure state and can be beaten into shape even when cold The Egyptians and the Sumerians of Mesopotamia may have used copper as early as 5 000 years before Christ It was in common use before the dawn of history The *metal was named for the island of Cyprus where the* Romans obtained their supply It was first called *cyprium*, then *cuprum*, and finally in English *copper*

American Indians made copper beads and tools long before the white men came Bronze an alloy of copper and tin, was used *so generally* in early history that one period is known as the Bronze Age (*see* Bronze) Brass was used in Roman times Copper and bronze were man's most important metals until he learned to make steel by smelting iron with carbon

The World s Leading Copper Producers

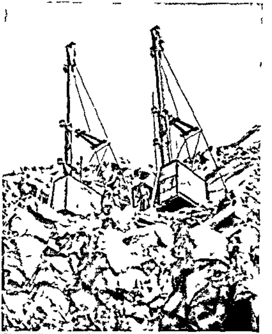
The United States usually produces about one-third of the world's supply of copper ore Chile is second, *with from one-seventh to one-fifth of the supply Its* mines are said to cost least of any to operate Next come Canada, Rhodesia, the Belgian Congo Soviet Russia, and Peru Less important producing regions are Yugoslavia *Japan, Mexico, Spain, Germany, Norway, Cyprus, Sweden, Turkey, and Australia*

Many producing regions ship the ore elsewhere, or smelt it without refining Considerable amounts of South American, Canadian, and Mexican ore and unrefined copper are made into finished metal in the United States In normal years Germany, France, and Belgium are important refiners

The first copper obtained in the United States was *mined* at Simsbury, Conn, *as early as 1709 Large*-scale mining began in 1845, in the Michigan deposits near Lake Superior Today Arizona, Utah, and Montana produce about three-fourths of the ore mined in the United States Nevada, Michigan, and New Mexico provide *most of the remainder* From 40 per cent to more than half the copper now used in the United States is reclaimed, or *secondary*, metal Consumption varies from less than half a million tons to more than one million tons a year

Important Uses of Copper

For cooking utensils, copper must be coated with tin to prevent the formation of harmful compounds Copper *is easily worked and ductile It can be cold*



These tall churn drills work in an open pit copper mine near Sudbury, Ontario The heavy bits are raised to the top by cable and then dropped, pulverizing the rock below Repeated blows drill a deep hole from which dynamite is exploded to blast loose the ore. *Power shovels then scoop up the loose rocks*

rolled down to one-thousandth inch in thickness and *by cold drawing its length can be increased* 5,000 times Hence it is ideal for making wire It has pleasing color and luster, it takes a high polish, and forms alloys readily with almost all metals (*see Alloys*) *It melts at* 1 083 1° C *(1 981 6° F)*

Thin plates of copper are used for engraving and etching, and in strong rollers for calico printing As an electrodeposit it makes plates and type pages *for printing (see Electrotyping) It makes* an excellent roofing material When exposed to wind, rain, and snow, it acquires a beautiful shade of green, called verdigris This protects it against further corrosion Chemical compounds of copper are used *as sprays to kill insects and fungi*

Copper Is Found in Many Forms

Nature has distributed copper widely It is found in many soils, in *mineral waters, ores, and in food* stuffs, both animal and vegetable Native copper is usually found near the surface, where the ore has been exposed to the elements Great deposits of such copper have been found in the Keweenaw Peninsula *of Michigan, sometimes in masses of 400 tons*

The large copper mines of the United States are models of efficiency The famous Red Jacket shaft of the Calumet and Hecla mine in northern Michigan *has a shaft about 15 by 25 feet, walled with brick* and cement and extending nearly a mile below the

surface of the ground. It is divided into six smaller shafts, two for the double-decked hoists that carry men and materials, two for the nine-ton self-dumping "skips" or buckets that bring up the ore, and two for the large cylindrical steel bailers that empty the water out of the mine.

The hoists travel even faster than the elevators in skyscrapers. At different levels they pass horizontal tunnels in which men are digging out the ore. Each tunnel has little railway tracks over which electric cars haul the ore and its own system of water pipes and hydrants with fire hose and extinguishers, electric alarms, and telephones.

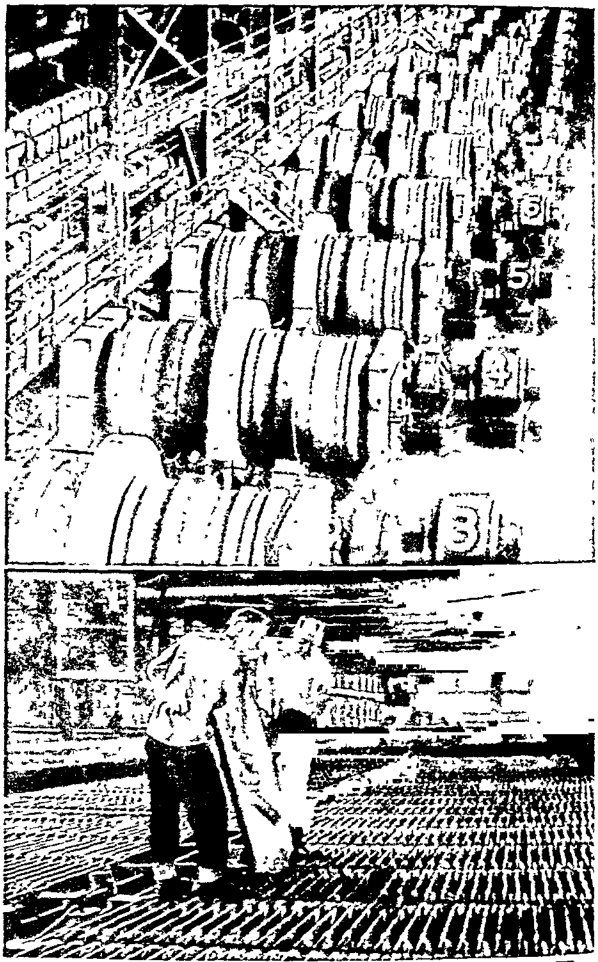
At the tunnels' ends, miners loosen the rock with powerful pneumatic drills. A ventilating system constantly forces air from the surface into the mine. At the bottom of this deep shaft the temperature would be around 90° F. if it were not cooled artificially.

Sometimes large copper deposits are near enough the surface to permit open-pit mining. In this method, power shovels scoop up as much as nine cubic yards of ore at a time and dump it into cars which carry it directly to the mills. Mining of this type has been successful at Bingham, Utah; Ely, Nev.; Chuquicamata, in Chile; Katanga, in Africa; and at Rio Tinto, in Spain.

Refining Copper by the Dry Process

Copper is separated from its ores either by a *dry* or *wet* process. In the dry process (also called pyrometallurgical, from "pyro" for heat), the ore is first reduced to a fine powder called *concentrate*. This is done in several steps. Large pieces are reduced in a jaw crusher, and pebblelike pieces in a roll crusher. Screens sort out finer material at each step, and jigging tables sort out particles which are fine enough to be used for smelting.

REFINING COPPER ORE



Crushed copper ore is ground fine in powerful mills (top picture). When operating with a full load of ore, each mill weighs one hundred tons. The bottom picture shows a section of a huge tank house where refined copper is produced by electrolysis.

Most of the crushed ore then passes through a desliming cone. Here worthless earthy material is dissolved in water and discarded. Again fine particles which are rich in metal are sorted out by a device called a Wilfley table. The rest is reduced to sandlike grains in a ball mill and treated further by a *flotation* process.

In this process, the grains are mixed with oil, and the mixture is pumped into a stream of rising water. Oil clings to the metal-bearing grains and the water carries them up. Nonmetallic earthy particles sink. The valuable particles so obtained go with the previously obtained concentrate to be smelted.

The first step in smelting is getting rid of sulphur in a roasting furnace. The furnace has several layers called "hearths." Hollow iron arms (sweepers) brush the ore around each hearth, then drop it to the next one. The arms are cooled by water inside. During this process, most of the sulphur is burned out and furnishes much of the heat by its burning.

Roasted ore is fed continuously into a *reverberatory* furnace. Here it lies on the bottom, and a hot fire is maintained over it by blowing in coal dust and air. The melted product flows out as slag (waste) and *matte*. Matte is copper with slight impurities.

Matte is refined further in a converter. This works like the Bessemer converter. A blast of air is blown through the molten matte from the bottom, and most of the remaining impurities are burned out. The molten matte is then cooled and shaped in molds.

Refining by the Wet Process

In the wet process, the copper is dissolved from the ores by acids, or is converted into a water-soluble salt by roasting with a reagent. The solvent is usually sulphuric acid, hydrochloric acid, or ammonia. The acid solution containing the copper is run into tanks and the copper is precipitated by means of metallic iron or by electrolytic methods. The precipitate is refined directly or smelted with matte. The method used depends on the copper content.

The blister copper produced in the converter is often refined again before being cast into ingots. This is done in a furnace similar to but smaller than the reverberatory furnace Pulverized coal is the usual fuel Copper from the converter is charged into the furnace and the end of an iron pipe carrying air under pressure of 16 pounds to the square inch is depressed below the surface of the bath The air oxidizes out the remaining iron and sulphur the iron forms a slag rich in copper which is returned to the converter The sulphur passes away with the furnace gases In this process part of the copper *oxidizes and dissolves in the bath* Carbon from poles of "green wood forced beneath the surface reduces the oxide back to metallic copper It is then cast into ingots of about 500 pounds each

Making Electrolytic Copper

A final refining by electrolysis (*see* Electrolysis) produces copper almost entirely free from impurities sometimes 99 98 per cent pure This process also recovers the gold and silver in the ore These metals are precipitated in the electrolytic bath and collect as sludge in the bottom of the tank where they are recovered for refining

Copper may be cast at the refinery into square cakes or slabs for rolling purposes or into circular cakes for large seamless cylindrical products such as tanks and hot-water heaters Other forms are round billets for seamless copper tubing and bars *for making wire (see* Wire*) It is cast as ingots if the* copper is to be remelted in crucibles for making copper castings or for making alloys such as brass bronze or nickel silver

The ingots are usually about ten inches long and weigh 16 to 22 pounds They are made with one or two notches so they can be broken easily to fit into the crucibles. Small ingots are hard to handle and so ingot bars are often cast instead A bar consisting of three ingots 32 inches long weighs 70 to 80 pounds Copper bars for making wire are rolled out into rods $\frac{1}{4}$ to $\frac{5}{8}$ inch in diameter For trolley wire many such rods are brazed together with silver solder into lengths of as much as a mile weighing from 1 600 to 3 380 pounds Cables and strands for power transmission are made by intricate machines which wind a number of wires around a central core

The Commonest of Copper Alloys

Brass the most common copper alloy contains from 55 to 70 per cent copper The remainder is zinc with perhaps lead or other material It has many uses both practical and ornamental (*see* Brass)

Other alloys of copper are important industrially Aluminum bronze (copper 90 per cent aluminum 10 per cent) is a malleable very tenacious material with a golden color It is much used in jewelry working German silver (copper 50 per cent zinc 25 per cent nickel 25 per cent) has many uses to take the place of silver *Unless properly coated however to prevent* oxidation, it may form harmful compounds It takes a *high polish and is harder* than silver For certain mechanical parts which receive hard and constant usage German silver is made still harder by the addition of aluminum

Monel metal (made from ores whose natural contents are nickel 68 to 70 per cent iron 1 5 per cent, the rest copper) is silver white in color Strong and tough it is highly resistant to corrosion and withstands all but the strongest acids and alkalies Hence it is used for ship propellers valves pumps and chemical equipment (*See* Alloys Bronze Nickel)

Chemical Compounds of Copper

The chief copper ores are the sulphide *chalcocite* chemical symbol Cu_2S and the copper bearing pyrite *chalcopyrite* $CuFeS_2$ Other copper ores are *covellite* CuS *bornite* Cu_5FeS_4 *enargite* Cu_3AsS_4 *cuprite* Cu_2O and *malachite* $Cu_2(OH)_2CO_3$ About half the world s copper comes from chalcocite Chalcopyrite yields about 25 per cent native copper of Michigan more than 5 per cent The remainder comes mostly from the oxide ores (*See* Minerals)

The two most important oxides are cuprous oxide (Cu_2O) found in nature as the mineral cuprite and used in testing for diabetes with Fehling s famous solution and cupric oxide (CuO) Both oxides are used in dyeing paper calico and glass Cupric chloride ($CuCl_2$) is a powerful disinfectant and is used in calico printing There is also a salt cuprous chloride ($CuCl$) Two sulphides are known Cuprous sulphide (Cu_2S) occurs in nature as chalcocite and cupric sulphide (CuS) is found as covellite This is the most nearly insoluble copper salt used in laboratories

Copper (or cupric) sulphate ($CuSO_4$) is the most widely used copper compound It forms brilliant blue crystals The anhydrous powder is sometimes used as a drier for alcohol and other liquids Copper sulphate is used in electroplating calico printing and as a germicide and fungicide

COPPERHEAD *In woods fields and marshes lives* the poisonous copperhead snake It may be known by its broad flat head of polished copper color and its light brown body about three feet long with conspicuous red brown markings shaped like an hourglass or dumbbell The eyes have vertical elliptical pupils The snake will not attack if it is left undisturbed Copperheads are found in the United States east of the Mississippi River and from central Kansas south through Texas Other popular names for it are red adder red viper copper belly and pilot snake

Copperheads feed on frogs small birds and rodents They sleep by day and hunt at night In the winter *they hibernate under rocks or in holes* About a dozen young are born in the late summer They are born alive enclosed in a membrane from which they soon escape The tail at first is sulfur yellow

Copperheads belong to the family of pit vipers *Crotalidae The scientific name is Agkistrodon mokasen* (*See also* Rattlesnake Snakes)

COPRA Coconut oil the most important of vegetable oils is pressed from copra the dried meat of the coconut *(see Coconut Palm) The United States* alone consumes some 450 000 000 pounds of this oil in a year About three-fifths is used for soap and cosmetics the rest for margarine and confections Most of it comes from the Philippines but some is imported from the Malay Peninsula Australia Oceania and other tropical regions

Copra crushing to secure coconut oil is an important industry in America s west-coast ports chiefly San Francisco Los Angeles Portland and Seattle

Usually the copra is pressed cold first. This produces the best grade of oil, suitable for human food. More grinding and pressing with hot water or steam follows, until perhaps 65 per cent of the oil has been pressed out. The remaining cake provides a fine fertilizer or an excellent food for stock or poultry.

Natives at the coconut groves shake or pick the nuts from the trees and crack them open with machetes. The broken nuts are dried in the sun or on racks over fires of coconut husks. Copra is smoke-dried chiefly where frequent rains prevent natural drying. Other mechanical driers are also used.

Most copra is shipped to America or Europe to be crushed. Marseilles, France, has one of the world's largest copra industries. If it is crushed at the source, the oil is shipped in barrels or drums, in great tanks built into the holds of ships, or even in petroleum tank ships. Tankers which formerly returned from the Orient to America in ballast now find a good profit in this trade. This saving was made possible by a method of cleaning the tanks thoroughly with live steam after the petroleum cargo is discharged. The process removes all trace of the petroleum. The tanks are kept heated by steam or hot water to about 70° F. to prevent the oil from hardening.

Copyright and Trade-marks. Even as late as the 1700's the law offered no protection to English authors against printers who republished and sold their works without permission. Indeed it was not considered proper that gentlemen should receive pay for literary works, and many of them did not allow their works to be printed during their lifetime. Sir Francis Bacon published his essays only in order to forestall an unauthorized edition, and others of his time took the same course. Unscrupulous printers published Shakespeare's works as copied in short-hand at performances, and the author had no redress. The foundation law for British copyright was passed in 1709, giving authors control of their works for 14 years and renewal rights for 14 years more if still living. A law of 1909 in the United States superseded previous laws. Some amendments to this law have been made since.

Copyrights cover books; periodicals, including newspapers; lectures, sermons, and addresses for oral delivery; dramatic and musical compositions; maps; works of art and models, designs or reproductions of works of art; scientific or technical drawings or plastic works; photographs; prints or pictorial illustrations; and motion pictures, plays, and so on. A United States copyright extends for 28 years, with 28 years' renewal—56 years in all. To copyright a published work, two copies are sent to the Copyright Office at Washington with a $4 fee; the fee for unpublished work also is $4; for a photograph, when no registration certificate is asked, 50 cents. The usual form of notice is the word "Copyright," with date and owner's name. On maps, pictorial illustrations, photographs, and similar items, the notice may be merely the letter "C" in a circle, thus: ©. A Canadian or an English copyright lasts during the life of the author and for a period of 50 years after his death.

Under protection of the copyright laws authors of dramatic or musical works are able to get royalties for motion pictures, radio, television, or other mechanical reproductions. Penalties vary—from $50 to $200 fine for reproducing a copyrighted photograph to a maximum fine of $5,000 for making a motion picture of a play without permission. The damage done and willfulness of the infringement usually decide the penalty.

A convention at Berne, Switzerland, in 1886 provided for international copyrights, but the United States is not included because its laws require works be *manufactured* in this country; that is, plate-making, typesetting, binding, and other work for a book must be done here, unless materials for the work are not available in America. Foreigners whose countries extend protection to American authors receive similar protection in the United States by treaties with most countries. Before these agreements, America was flooded with pirated foreign works.

Trade-marks, unlike copyrights and patents, do not involve monopolies. Everyone has the privilege of making soap; a trade-mark simply gives the public an easy means of identifying a particular soap, thus making advertising more effective and substitution difficult. Trade-marks which have been extensively advertised for long periods are often worth as much to their owners as more tangible assets in the form of real estate and buildings. In the United States, registration of trade-marks is in the Patent Office. It does not create the right to use the trade name or device, although it creates a presumption in favor of the user. Ownership is acquired solely by priority of adoption and continuous use. In some countries the person first to register owns the mark regardless of whether he was the first to use it, and in such countries it is a common practice for unscrupulous persons to register in their own names valuable foreign trade-marks and then force the real owners to buy them out at high prices.

Coral. Among the important land builders of the earth are the corals. They are tiny sea-dwelling creatures whose skeletons by the countless millions accumulate to form islands and reefs. On the keys at the southern end of Florida are some of these islands in the making. They look like beautiful ocean gardens below the water surface. In fact, the scientific name of the corals, *Anthozoa*, means "flower animals." There are leaf corals and kinds that look like the tendrils of plants. Some are shaped like vases and others like feathers. Certain fan-shaped kinds are called sea fans.

The corals are delicately colored, but most of them lose their color upon being taken from the water. The red and salmon-pink precious coral from which jewelry is made is found in the Mediterranean Sea and off the coasts of Japan. Coral fishing and jewelry making are important industries in Italy. Common grades of coral are sometimes used with sea water

BEAUTY AND VARIETY IN A CORAL REEF

The Great Barr er Reef of Australia fringes the northeastern coast for 1,200 miles It is built up of the skeletons of countless billions of corals Most of the reef is under water but the low lying corals may be seen at low tide as shown here

This close-up of the Great Barrier Reef shows a brain coral at the upper left In the lower center is a large clam. Over the rest of the area grows a soft rubbery type of coral

This museum group gives an idea of the beauty of an under water scene in a coral reef The corals are richly colored and through the mazy rock glide delicate colorful schools of fish

to make concrete The land building corals are found only in shallow tropical waters where the temperature never falls below 70° F Other species are common on the north Atlantic coasts and even in the deep cold fiords of Norway

Life History

When the coral animal which is called a *polyp* is born it is a tiny jellylike oval a fraction of an inch long A fr nge of hairs enables it to swim about Soon it settles on a rock or on a p ece of dead coral and begins to grow The upper part of the body becomes dome shaped and it develops a stomach and a mouth Around the mouth grow a number of feelers or tentacles

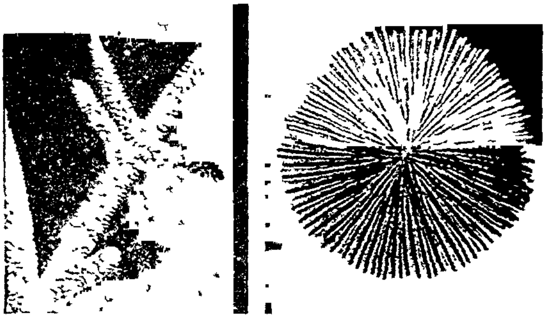
The polyp next bu lds a limey platform between its body and the rock on which it is standing Then around its soft body it builds an outside skeleton of l me Only the mouth and feelers reach out of this protective wall to feed upon the organisms float ng in the sea

The polyp reproduces by sending offshoots (known as buds) from its body These develop into other polyps In some kinds of corals the buds break away from the mother polyp to become separate individuals In other kinds they remain attached and in turn send out still more buds In this way vast colonies are bu lt up They are attached to one another by a network of tubes Food may be passed through the tubes from the outer edges of a colony to the members on the inside Year by year coral skeletons accumulate cementing together in one mass until after centuries new land is formed consisting of the skeletons of billions of dead polyps

How Coral Islands Are Made

Coral islands and reefs are most numerous in the warmer portions of the Pacific and in the Indian Ocean occurring to a less extent in the Gulf of Mex co and along the shores of the West Indies They belong to three classes *Barrier reefs* l e at some distan e from the land the space bet een being filled by a

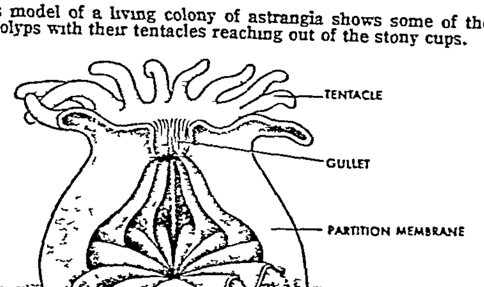
DIFFERENT KINDS OF CORAL



At the left is a branch of elkhorn coral The polyps live inside the tiny cups At the right is the skeleton of a solitary coral, showing its beautiful radial symmetry.

This museum model of a sea fan shows better than a living specimen the plantlike form of the colony. It is a deep purple.

This model of a living colony of astrangia shows some of the polyps with their tentacles reaching out of the stony cups.



This cutaway drawing of a stony coral polyp shows the different parts of the body and the outer cup of limestone.

shallow lagoon of salt water. Usually some parts of the reef rise above the ocean as islets, supporting a scanty vegetation, while the greater part is submerged. The Great Barrier Reef of Australia, more than 1,000 miles long and 10 to 90 miles wide, is an illustration of this type.

Atolls are not attached to any visible land. They are circular in form, surrounding a central lagoon of placid water. (For pictures of how atolls are formed, *see* Pacific Islands.) When, as usually happens, there are passages through the reefs, they form an excellent harbor for ships during a storm. *Fringing reefs* simply skirt the coast line and extend the beaches.

Corals are closely related to the sea anemones, belonging to the class *Anthozoa* of the division *Coelenterata*. Certain polyps of the *Hydrozoa* class, as well as the lime-forming seaweeds, also play a great part in the formation of coral reefs and islands

CORINTH, GREECE. No other city in ancient Greece held so commanding a position as Corinth. It was situated on the Isthmus of Corinth, the narrow neck of land connecting northern Greece and the Peloponnesus. On the west lay the Corinthian Gulf and on the east the Saronic Gulf (or Gulf of Aegina). Corinth was long the leading naval power and one of the foremost colonizing states of Greece, founding among others the famous colony of Syracuse on the island of Sicily. Corinth was also noted for its extensive commerce and manufactures. Its richly ornamented vases and metalware were exported to many lands. The most ornate order of Greek architecture is called "Corinthian" and was said to have been invented by a Corinthian architect (*see* Architecture).

The Romans destroyed Corinth after crushing an uprising in 146 B.C. and carried away many of its art treasures. A hundred years later it was rebuilt by Julius Caesar and again became a great trading center. The apostle Paul came as a missionary to Corinth, founded a church there, and to its members he addressed his Epistles to the Corinthians (*see* Paul).

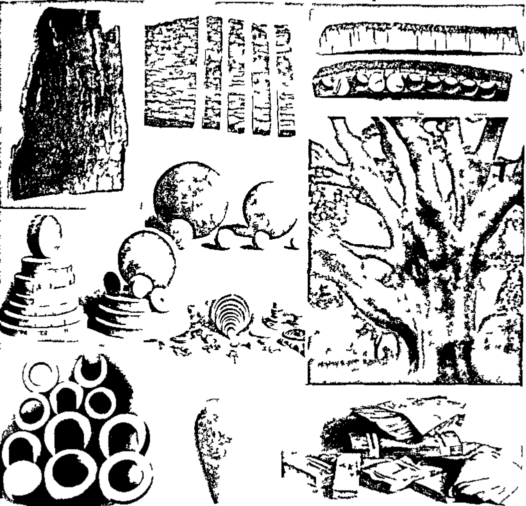
Frequent earthquakes and the looting and destruction by conquering hordes gradually reduced "the light of all Greece" to a heap of rubble. The splendors of old Corinth have vanished, except for occasional ruins uncovered by archaeologists. A fine Roman villa, five temples, and parts of the great theater have been excavated.

After the earthquake of 1858 the ancient site was abandoned. A new city, built on the gulf three miles to the northeast, was almost destroyed by an earthquake in 1928. The present city of 17,728 people (1951 census) is little more than a local trading center.

A four-mile canal through the Isthmus of Corinth was completed in 1893. It provides an essential shipping route between the Ionian and Aegean seas. It is narrow, however, and large vessels have to go around the peninsula.

During the second World War, Corinth was occupied by the Germans from April 1941 until October 1944, when it was freed by British troops.

HERE'S THE STORY OF CORK FROM TREE TO BOTTLE



Cork starts life as the outer bark of the stately Portuguese and Spanish cork-oak trees like the one shown at the right. When thick enough the bark is peeled off in slabs such as you see in the upper left hand corner. These slabs are sliced into strips and from the strips corks are punched. Spheres for centers of baseballs, washers for machines, fishing line floats and thin sheets for cigarette tips are cut by special machinery.

Cork. It seems strange that while some kinds of oak trees give us one of our heaviest common woods that the bark of another kind should supply us with a substance so light that life preservers are made of it. Cork comes from Spain, France, Italy, Tunis, Algeria and Morocco. But the cork-oak forests of Portugal contribute half of the world's annual crop. Thousands of men find work in the deep shade of the gnarled old trees with their evergreen leaves and their rough trunks. After the bark is stripped from the trees new layers grow back slowly and a fresh sheathing from ½ inch to 2½ inches thick is ready for cutting every nine or ten years. The trees are about 20 years old when they yield their first crop which is so rough and coarse that it is worth little. The second stripping gives a better quality but the best harvests do not come until the oak is about 40 years old.

The stripping is usually done in July or August. With a sharp knife or hatchet a cut is made around the trunk near the base and another just below the branches. These cuts must not injure the inner layer or the trees will stop growing. The two incisions are joined by long lengthwise cuts. Then inserting the wedge-shaped end of his hatchet handle the workman pries off the sheets. The branches yield a thinner layer but one of fine quality. Anywhere from 45 to 500 pounds of cork may be taken from a single tree.

After seasoning for a few days, the cork sheets are boiled in great vats to remove the tannic acid and to soften them so the hard outer covering can be removed. At the seaport the bark is pressed into bales and loaded on vessels. At the factory the slabs are softened by steaming, sliced into strips by circular steel knives, revolving hundreds of times a minute, and from these strips the "corks" for bottles are cut by other machines.

The valuable properties of cork—its lightness, elasticity, and impermeability to water—are due to the fact that it is made up entirely of thin-walled cells filled with air. Today the list of useful articles made from cork is a long one. Glass manufacturers polish their wares with cork wheels, artificial limbs are made of cork, and cork paper (so thin that 500 sheets make one inch) is used for the tips of cigarettes. Since cork is a very poor conductor of heat and cold, helmets of cork are worn by white men in the tropics as protection against sunstroke Ground cork is used as the basis of a number of cements and coatings for insulating steam pipes, and in constructing refrigerators, etc. Another important use is in the manufacture of linoleum, which is made from ground cork, linseed oil, gums, and pigments (*see* Linoleum). The coarsest grade of cork waste is used to pack china and fresh fruit. Parings of cork, burned in closed vessels, make Spanish black, a beautiful and durable paint.

Scientific name of cork oak, *Quercus suber*. The tree attains a height of from 20 to 60 feet and is sometimes as much as 4 feet in diameter. The leaves are evergreen, oblong, somewhat oval, downy underneath, and waved

CORK, IRELAND. Cork is the second city and one of the leading seaports of Ireland. It lies on the southern coast, where the estuary of the river Lee provides a spacious harbor for ships up to 20-foot draft. Transatlantic vessels make regular calls to Cobh, which lies on an island near the harbor's mouth. The calm island-crowded waters and the wooded shores dotted with resorts make Cork harbor a charming picture.

The city owes its importance largely to trade with Great Britain. It sends large quantities of meat and dairy products in exchange for cereals, coal, and manufactured goods. Cork's chief manufactures include automobiles, leather, iron, glass, gloves, textiles, and fertilizers. It also has large shipyards, distilleries, and breweries. Among its fine buildings are a Protestant and a Roman Catholic cathedral and the University College, a constituent college of the National University. Part of the business section was burned in 1920 after a conflict between the Royal Irish constabulary and Sinn Fein forces.

The name "Cork," which means "swamp," was probably once deserved by the site. The city was founded about A.D. 600. It was frequently pillaged and for a time occupied by the Northmen in the 9th and 10th centuries. Until 1172, when Ireland acknowledged the sovereignty of King Henry II of England, Cork was ruled by native princes. Since 1929 the city has been governed by a lord mayor, a city manager, and an elected council of 21 members. Almost 85 per cent of the inhabitants are Roman Catholic. Population (1951 census), 74,567.

The county of Cork, second largest in all Ireland, is famous for its dairy industries. A few miles from the city are the ruins of the ancient Blarney Castle. One of the stones of the tower is the famous Blarney Stone. Those who kiss this stone are supposed to receive the power of clever flattering speech.

Where KING CORN *Yields* BOUNDLESS WEALTH

CORN. The farmers of the Mississippi Valley think so much of their corn that they call it "King Corn." The title is most fitting. Corn is the American "king of crops" by any test. Farmers use more land for it than they do for any other crop. It provides more food for animals and men than any other crop. And it brings American farmers more money.

In an average year the corn crop in the United States is about 3 billion bushels and is worth about 4 billion dollars. In some peak years the crop has totaled almost 4 billion bushels, valued at about 5 billion dollars. Farmers use some 90 million acres of land to raise this huge crop.

Most of the corn the farmers grow is the coarser kind called field corn. It is not grown for men to eat. Farmers feed it to hogs, cattle, and other animals. Out of every 100 bushels grown, farmers store between 80 and 90 bushels in silos or in bins for feeding livestock. For this reason we cannot measure the value of the corn crop by what is sold as grain. Most of the yearly crop "goes to market on four legs" as hogs and cattle. Thus a large part of a 4-billion-dollar corn harvest never reaches the grain market.

Where Corn Grows throughout the World

Out of every two bushels of corn grown in the world, farmers in the United States produce one. Every state grows some corn, but most of it is raised in the famous "corn belt." This vast fertile region extends across the north-central plains from western Ohio to eastern Nebraska. The top ranking corn-producing states are Iowa, Illinois, Minnesota, Indiana, Nebraska, and Ohio. They are all in the "corn belt." In the growing season tall, green corn stalks, with their golden-tasseled heads, broad, green leaves, and fat ears, stand in almost every cultivated field in the belt. Neat rows of plants stretch for hundreds of miles and promise harvest-time wealth for the farmers.

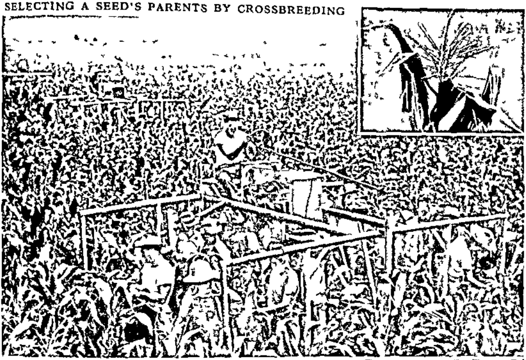
Corn will grow wherever it has suitable soil, freedom from frost and cold nights, and plenty of hot sun when it is maturing. It also needs ample soil moisture during the hot season. These conditions prevail in much of Central and South America, around the Mediterranean, in India, and in South Africa. In South Africa corn is called *mealies*, and it furnishes the principal food of the natives.

An Obscure Ancestry

Farmers think of the corn plant as something quite natural, like grass or trees. But it puzzles botanists, particularly because they cannot identify any wild ancestor.

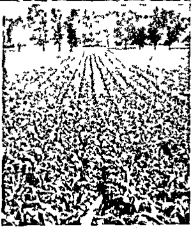
When Columbus first came to America, he found American Indians growing corn. But even in the time

SELECTING A SEED'S PARENTS BY CROSSBREEDING



This small dry ear of corn is the result of poor seed careless cultivation and neglect

The result of select seed and intelligent scientific farming is a full ear like this one



Hybrid corn is produced in crossbreeding fields (top) Workers ride on tractor drawn scaffolds, pulling the tassels (close up, top right) off certain rows of one kind of corn The detasseled plants will be fertilized by pollen carried by the wind from the intact tassels of other rows of another kind of corn Seed grown on the detasseled plants will be a hybrid with the good qualities of both parents The bottom pictures show two fields, one with poor seed corn (left) and one with good corn (right)

of Columbus, corn could not take care of itself like a wild plant or a recent descendant of a wild plant The greatest weakness lay in the way corn produces its seed The top of the stalk has a many spiked tassel which grows pollen The plant also has "ears" with filaments called "silk" which receive pollen But the ears are completely wrapped with leaves and the ends of the silks protrude only from the tips Therefore the silks cannot get ample pollen unless the plants have many neighbors as they do in a cultivated field Botanists think that the plants could hardly survive in the wild state Corn was apparently unknown in ancient times in the Old World No evidence of it has ever been found in archeological remains There is no reference to it in the Bible or other ancient literature or in primitive art In the New World, however, all the principal types of corn that scientists recognize today were already in existence and under cultivation by the time the first explorers arrived It is believed, therefore, that the wild ancestor of corn must also be found in the Western Hemisphere

Some botanists think that the plant may be descended from a grass, *teosinte*, which grows wild in Mexico and Guatemala. Another theory is that it originated in South America from a primitive pod corn which was also a popcorn. Pod corn has its kernels enclosed in a pod or chaffy shell. Such a wild corn has not yet been found.

In 1948, scientists of the Peabody Museum, Harvard University, discovered ancient corn in a cave in central New Mexico. The lowest levels of the cave floor contained primitive husks and kernels estimated to be 4,000 years old. This corn bore no relationship to teosinte, but it did have the characteristics of pod popcorn. In upper and more recent deposits the scientists found corn that appeared to have been crossed with teosinte. Modern corn may therefore be a hybrid of teosinte and wild species which no longer exist, but the mystery is still unsolved.

The Corn Plant and Its Seed

The tassel-and-silk arrangement works well, however, if men help the plant by giving it care. To see how it works, suppose we get acquainted with the corn plant.

The corn plant is a large member of the grass family (*Gramineae*). It has a fibrous, woody stalk that may grow to be from 6 to 20 feet high. At the top is its spiked tassel. This part grows the male flowers of the plant. (For an explanation of "male" and "female" flowers, *see* Flowers.) Farther down, the stalk grows one or more spikes which develop into ears. Each one grows out from beneath the base of a leaf, and at first it is completely wrapped in leaves. The spikes bear threadlike filaments (silk) which are the female flowers. Each filament grows from a germ on the spike called an *ovule*.

The ovules are arranged in neat rows along the spikes. Each one will produce a seed, called a kernel, if the filament of silk is fertilized by a grain of pollen. To catch pollen, the green, tender tips of silk protrude from the top of the leafy wrapping around the spike.

All these parts appear after the stalk and leaves are well grown, and the plant is receiving plenty of summer sunshine. When the flower parts develop, farmers say that the corn is "tasseling out." Soon the tassels produce yellowish dust-like grains of pollen. Each grain of pollen contains two sperms.

Now summer breezes gently shake the pollen-laden tassels, and billions of the tiny, sperm-bearing pollen grains jar loose. The wind carries them to the silk of neighboring plants. Tiny receivers, called *stigmas*, at the ends of the silks, catch the pollen. Promptly the pollen grains send tubes growing down through the silks to the ovules. Then the sperm cells pass down the tubes and fertilize the ovules. Thereupon the spike grows into a large, pithy structure called a *cob*, while the ovules grow and ripen into seeds (kernels). The growing seeds are made up of a rather soft yellow hull filled with a milky liquid. Corn at this stage is "in the milk." The "milk" has a fine sweet flavor, and field corn in the milk stage may be used for roasting ears. When field corn is ripe, the kernel is hard, firm, and starchy. Sweet corn kernels do not get as hard.

Colors of Corn

When white men first came to America, they found corn with different colored kernels. The Indians liked particular colors for certain purposes and tried to grow them.

The pioneers preferred the yellow kind for field corn. About 1779 sweet corn was found in Penn-

KING CORN

Almost all corn plants stand several feet high. At the top of this plant we see the tassel. It contains the male flowers. Below the tassel are broad green leaves. Among them we see ears of corn, wrapped closely in coverlets of leaves. Hundreds of filaments, or silks, protrude from this leafy covering. These are female flowers. Although each corn plant can pollinate itself, nature has made this very unlikely by covering the silks with leafy wrappings. At the bottom of the stalk, we see the long grasslike roots. They reach deep into the soil to get food and moisture for the plant.

sylvania Gradually farmers began to save seed from desirable plants for planting the following year Thus they developed various kinds or *strains* of corn

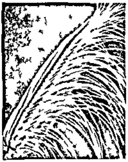
How Experimenters Developed Hybrid Corn

In 1905 George H Shull and Edward M East began developing new kinds of corn by placing pollen from one desirable strain of corn onto the silks of another strain The process produced cross-bred strains called *hybrid* corn After the first World War Henry A Wallace (who became secretary of agriculture in 1933) and Lester Pfister began hybridizing experiments By 1926 they had made hybrid pollinization completely workable

The hybrid plants are remarkable growers They commonly grow to be 18 or 20 feet tall some have grown as high as 28 feet A more important factor is that they have added millions of dollars to the income of corn farmers

Before farmers had hybrid corn an average acre of corn yielded 30 bushels But farmers had to spend the money they received for 25 bushels to pay their costs for each acre they planted They had only five bushels an acre for profit Hybrid corn has increased the yield by 30 per cent It produces 50 or more bushels an acre on many farms Some farms produce more than 200 bushels an acre

A SILKEN EAR



Here is an immature ear of corn with the covering leaves stripped back Notice how the filaments of the silk grow out of the rows of ovules

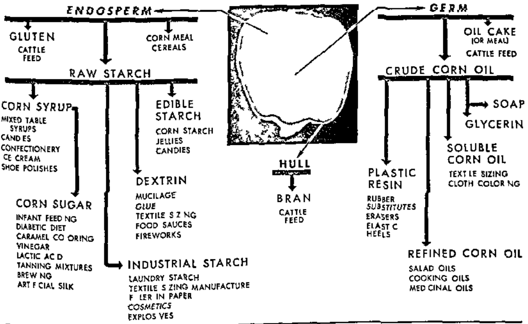
A hybridizer produces hybrid seed by first *inbreeding* This fixes desirable qualities in the seed He covers the ears of selected plants to keep air borne pollen from the silk Later he takes pollen from the tassels of a plant and dusts it on the silks of the same plant After inbreeding each strain for several generations he starts *crossbreeding* He takes pollen from the tassel of a plant having one desirable strain and dusts it on the silk of a plant with some other strain The crossbred product or hybrid has the qualities of each parent strain

Next comes *double-crossing* The experimenter dusts pollen from one hybrid onto a hybrid with two other strains The seed from this cross produces a super corn with four strains bred in This corn is sold to farmers as seed Their crop cannot be used as seed next year because hybrid corn is not self perpetuating Farmers must buy new seed each year Great use of hybrid corn threatens the supply of corn pollinated naturally This loss would restrict improving hybrid strains and prevent developing new ones To preserve seed of native varieties the Federal government stores seed in corn banks

Planting and Cultivating

A strong full crop of corn comes from fertile soil, good seed thorough cultivation and clean culture

THE CORN PLANT GIVES US HUNDREDS OF USEFUL PRODUCTS



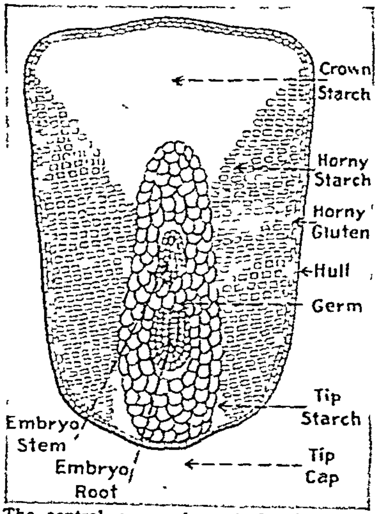
Above we see a kernel of corn cut across and shown many times enlarged (A diagram of the internal structure appears later in the article The rest of the diagram lists many useful products we get from the three main parts (endosperm germ and hull of the corn kernel. The whole kernel is also used to produce alcohol and distilled beverages Many other products come from the cobs and stalks

For corn, the farmer needs soil that is easily worked, well drained, and rich in plant food (*see* Soil). The dark loam of Iowa, "the state where the tall corn grows," is particularly adapted for corn. Lighter soils in other states can be made suitable for corn with proper fertilizers (*see* Fertilizers). For help in choosing fertilizers, a farmer can consult the United States Government farm advisers (often called "soil doctors"). They will test samples of soil to find deficiencies and suggest the kind of treatment to give.

Next, the farmer carefully chooses the seed to suit conditions on his farm. He loosens the soil thoroughly and then plants the seed. In dry regions, he may plant corn in deep furrows. If the rainfall is plentiful, the farmer puts the seed down in hills or in drills. Once the plant starts to grow, cultivation must never be deep, or the tender, grasslike roots will be injured.

Corn has well been described as a "heavy eater." Each crop draws heavily on the plant food in the soil, leaving little for the crops that follow. Production is higher when corn crops are rotated on a three-year cycle. The first year a legume, such as alfalfa or sweet clover, builds up the soil with nitrogen and humus. The next year, corn grows tall on these, its favorite foods. The third year, a small grain is planted. Then the cycle is renewed with a legume (*see* Alfalfa; Nitrogen).

STRUCTURE OF A CORN KERNEL



The central germ element develops this structure into a complete plant.

Different Ways of Harvesting

Corn farmers choose their harvesting methods according to how they want to use the corn. If the farmer wants to store the whole plant in a silo, he cuts the plants while they are still green (*see* Silo). If the corn is to be used for grain, it is not harvested until it is fairly dry. The ears may be picked by hand from the standing corn and husked and thrown into a wagon, or a mechanical corn picker may be used to save time.

Some farmers turn cattle in to feed on the corn stalks after the ears are picked. Others cut the stalks, tie them into shocks, and let the ears get dry before husking. Many livestock raisers turn hogs into the ripe fields to feed and fatten on the corn. This method is called "hogging down."

Fighting the Enemies of Corn

The corn plant has many enemies. More than 350 insect pests attack the precious grain. The most destructive are the corn ear worm, the European corn borer, and the corn root worm. Fungus growths, such as smut and various rots, are costly foes. In most cases, insecticides are too expensive to be practical. Therefore the farmer uses the less expensive methods of "clean culture" and crop rotation.

Clean culture means harvesting or destroying every part of the plant. Careful farmers either burn or plow under the stubble. This rids the corn field of pests which live above the ground. Crop rotation suppresses root pests that live on corn by depriving them of food for one or two years.

Where Does the Corn Crop Go?

Nearly four-fifths of the corn crop goes to fatten livestock. Much of the remaining grain is made into human food as corn meal, dry breakfast cereals such as corn flakes, syrup, oil, and starch. Removing the hull and softening the inside of the kernel produces hominy (also called samp). Some people make hominy at home by removing the outer covering with lye and cooking the whole grain. When the kernel is crushed it forms hominy grits.

Countless other products are made from the kernel and the stalk. Let us split a kernel of corn in two. We find three parts—a hard, horny hull, a small germ at the point, and a white "filling" called endosperm.

When the kernel serves naturally as a seed, each part has its use. The hull protects the inner parts. The germ contains the vital parts which produce a new plant. The endosperm provides nourishment for the growing germ until the new plant grows roots and leaves and can get food from the soil and the air.

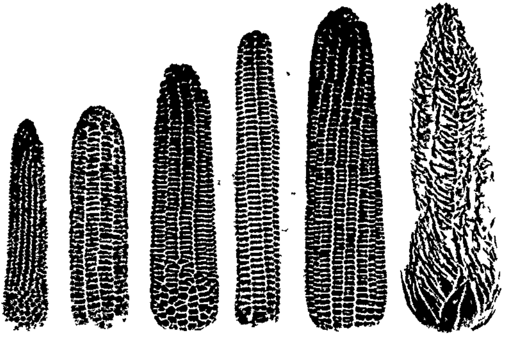
Man has his own uses for the same parts. The hull comes off as *bran* and has little value except as cattle food. But the rest of the kernel can be made to yield many products. The germ yields corn oil. When oil is squeezed from the germ, a cake is left. It is used to fatten cattle. Corn oil can be refined into oil for salads and cooking. Inferior oil is used for soap and glycerin (and sometimes nitroglycerin, from which dynamite is made). Chemical treatment of the germ yields a gum called "pargol," which is used instead of rubber in many articles such as elastic sponges, rubberoid shoe soles, and erasers.

Cornstarch, Syrup, and Gluten

We have many uses for starch from corn. It is a good substitute for talcum powder. It is used in cooking and to stiffen linen. Cornstarch can be treated to produce glucose, corn syrup, and other sugary substances. It also yields gums that are used on envelopes and stamps and for holding together sand in molds for castings.

Corn gluten gives us vegetable glue and gluten meal. Farmers mix the meal with bran for cattle feed. An immense quantity of corn is used for making whiskey and alcohol. Corn cobs are made into tobacco pipes. Millions of tons of corn stalks go into a hard rubber substitute called "maizolith." A large quantity is used for making paper and wall board. The gases from

DISTINGUISHING THE SIX PRINCIPAL TYPES OF CORN



F om left to right we see ripened ears of popcorn sweet corn soft corn (also called flour corn) flint corn dent corn and pod corn. The kernels are ready to be shelled and used for seed. Dent corn wh ch is the most wide y produced of a l in the United States ge s ts name from the small dents which form at the top of the kerne s when they dry out Flint corn next in importance has an ex tremely hard flinty coating around the starchy interior The Indians knew and used all six types before white farmers adopted them.

fermenting corn or corn waste are used to make methanol (wood alcohol)

Many Varieties of Corn

The Indians had many kinds of corn and white men have produced more than 1 000 named varieties The smallest is the golden thumb popcorn plant about 18 inches high Some varieties have only eight rows of kernels Others have as many as 48 rows Colors in clude white and shades of yellow red and blue

The chief types of corn are pod soft sweet pop flint and dent corn Pod corn has each kernel en closed in a pod or husk Soft corn is used for corn flour and for roasting ears Sweet corn has the small est amount of starch popcorn the highest Flint and dent corns lead all other varieties on the grain markets and for livestock feeding

Corn is usually called maize outside the United States and Canada It may be called Ind an corn be cause the Amer can Indians were first to grow it In other English speaking countries the word corn may mean any edible grain In England it usually means wheat The largest exporter of corn is Argen tina Other large corn produc ng countries are Ru man a Yugoslavia Hungary Italy the Soviet Union Braz l Mexico China India Indonesia Union of South Africa and Egypt The scientific name of corn is *Zea mays*

CORNEILLE (*kôr na yü*) PIERRE (1606–1684) The French playwright P erre Corneille lives in the his tory of the theater as the father of French tragedy In Corneille s time French dramat sts were bound by certain rules called *Unities* All action in plays had to be confined to 24 hours with as few scene changes as poss ble all plays had to have five acts and no violence could take place in view of the audience

Restricted by these rules other men wrote second rate plays Corneille followed the same rules and wrote what were considered masterpieces in his time S udents today read his plays but they are rarely produced on the stage His noble heroes come to tragic ends through the overwhelming forces of fate

His verses are powerful; his ideas are firm and clear-cut. His greatest work is 'The Cid'. The story is based on the life and exploits of an 11th-century Spanish hero. Corneille's plays were very popular, but he often quarreled with his critics and with his patron, Cardinal Richelieu.

Corneille was born in Rouen, in Normandy, June 6, 1606. His father was a magistrate and the boy was educated to be a lawyer. His first play was produced when he was 23. He was married at 34 and had six children. He lived a middle-class existence, very different from the grand lives portrayed in his plays. He died Sept. 30, 1684.

Corneille's chief works were: 'Médée' (1635); 'Le Cid' (The Cid) (1636); 'Horace' (1640); 'Cinna' (1640); 'Polyeucte' (1642?); 'Le Menteur' (The Liar) (1642); 'Andromede' (1650); 'Don Sanche d' Aragon' (Don Sancho of Aragon) (1650); and 'Oedipe' (1659).

CORONADO (*kô-rō-nä'dō*), FRANCISCO VÁZQUEZ DE (1510–1549). One of the strangest journeys ever made in search of gold was led by the Spaniard Francisco Coronado. He expected to find seven cities filled with treasure in the wilderness north of Mexico. For two years he led an army of men over thousands of miles of unmapped country. Instead of wealth he found nothing but poor Indian villages. But he established Spain's later claim to land which is now about one-third of the United States. It stretched from California into Oklahoma and Kansas.

Coronado made this futile journey more than four hundred years ago. He did so because in his time men were ready to believe almost any wild story about gold. While Coronado was still young, vast stores of gold were found in Mexico and Peru. Captive Indians tried to escape torture by telling the Spaniards that gold was always to be found "somewhere near."

Coronado was born in a noble family of Salamanca, Spain, in 1510. He was a younger son, and therefore had to win his own fortune. He grew up hearing tales of fortune and adventure to be won in the New World. As a young man at court he became friendly with Antonio de Mendoza, one of the king's favorites. Mendoza was appointed viceroy of New Spain in 1535, and Coronado accompanied him to America. In Mexico City Coronado married wealthy Beatriz Estrada, whose father had been royal treasurer of New Spain. In 1538 Mendoza made Coronado an alderman of Mexico City. The next year he became governor of New Galicia, a province in western Mexico.

The Seven Cities of Cibola

Explorers returning from the north brought back stories of the wealthy "Seven Cities of Cibola." The news excited all the Spaniards in Mexico, and Mendoza promptly organized an expedition to seize the treasure. He was glad also to send the idle young nobleman and soldiers of his court on the errand before they caused trouble at home.

Mendoza made Coronado the commander of the expedition. It had about 230 horsemen; 60 foot soldiers; about 1,000 Indian warriors and Indian and Negro servants; several Franciscan friars; and two white women, wives of expedition members. There were hundreds of extra horses and pack animals, and herds of cattle and sheep for meat supply. Their weapons were bronze field pieces for hurling stones, harquebuses (forerunners of muskets), and crossbows, lances, swords, and daggers.

Coronado led his party from Culiacán, a northern outpost of New Galicia, in April 1540. The expedition advanced north and came upon the first of the "seven cities" in July. It proved a vast disappointment. There were no gold and jewels. The "Seven Cities of Cibola" were actually the Indian pueblos of present-day Zuñi in western New Mexico. From here Coronado sent out scouting parties. One party discovered the Grand Canyon. Another found more pueblos in a fertile area of the Rio Grande Valley.

Here the expedition spent the winter. New hope came when a Pueblo slave, a plains Indian, told of a new land to the northeast. He reported that its capital, Quivira, was richer than anything the Spaniards had dreamed of. With 30 men and the slave as guide, Coronado set forth.

On the plains of the Texas Panhandle they saw their first herd of buffalo (bison). After wandering for months they found Quivira in central Kansas. But it held only Indian tepees. The slave confessed that his story was invented to lure the Spaniards to their death on the plains. He was executed. Coronado brought his men back to the Rio Grande.

After spending a second winter in the pueblos, the expedition started homeward. The tattered army followed a weary route over deserts and mountains in blazing summer heat. In the autumn of 1542 Coronado led only about 100 men into Mexico City. The remainder of those who survived trailed in during the next months. In 1544 Coronado was charged with corruption and negligence and removed as governor of New Galicia. He returned to Mexico City, where he retained his post as alderman until he died in 1549.

COROT (*kô-rō'*), JEAN BAPTISTE CAMILLE (1796–1875). Before the period of the French Impressionists, with their daring use of color, one of the leading painters of the 19th century was Camille Corot. His classic landscapes and figures are still much admired, and his paintings form a part of most large museum and private collections.

Corot was born in Paris on July 17, 1796. His parents operated a successful dressmaking establishment, and they gave the boy a good education. After attending college at Rouen, he was apprenticed to a cloth merchant. Corot did not like the work, and after five years he won his parents' reluctant consent to study art. They had to support him for many years. Long after he had won acclaim from art critics, he still could not sell his paintings.

He studied under teachers in Paris and Rome and later traveled over Europe in search of new scenes to paint. He never married. Late in life he began to earn great sums for his work; but he continued to live simply, and he gave generous help to young painters and others. He died Feb. 22, 1875.

The tranquil landscapes Corot loved to paint reflect his own happy life. He never suffered privation or lacked friends. For many years only his pupils and fellow artists found beauty in the quiet tones and shades he used for misty dawns, hazy trees, and mirroring waters. In later life honors were heaped upon him. He won several medals and was made an officer of the Legion of Honor. He was one of the greatest of the Barbizon school, a group of artists who did much of their work at the little village of Barbizon on the edge of the forest of Fontainebleau (*see* Painting section, List of Terms.) He has been called the "lyric artist," and his pictures have been described as "painted music."

Corot's paintings are widely distributed. Boston's Art Museum displays the famous 'Forest of Fontainebleau.' The Chicago Art Institute has 'Just before Sunrise'; the New York Metropolitan Museum has 'Ville d'Avray.' The popular 'Dance of the Nymphs' is in the Louvre, Paris.

CORPORATIONS. Every day each of us does some business with a corporation. Corporations make and distribute most of the things we buy. They supply services such as gas, electricity, telephone, and transportation. They publish newspapers and books and furnish radio and television programs. They run private colleges, churches, hospitals, charitable institutions, and coöperative enterprises. Even towns and cities are incorporated. Most wage earners are employed by corporations. Many people receive some of their income from lending their savings to corporations.

We usually think of a corporation as a big business. Actually most corporations are small. A small business, however, could function without the corporate form of organization. For the big business it is indispensable. Great sums of money are needed to build a railway or set up a factory using mass-production methods. This money must be secured from many people. No one would invest his savings in a large business if he were responsible for all its debts—as he would be in a personal enterprise or a partnership. He *may be willing, however, to risk some of his* savings in a corporation, because he knows he can lose only the money he puts in. This is called *limited liability*. In England and Canada *Ltd.* (limited) is the last word in a corporation name. In the United States *Inc.* (incorporated) usually follows the name of the corporation.

Suppose three men decide to form a corporation to manufacture shoes. They first apply for a charter from a state government. The charter states the name of the corporation, its purpose, the names of the founders, and the amount of money that will be invested in the business. This investment is called the *capital stock*. It is divided into parts called *shares*. The incorporators may buy all the shares of stock or sell some to the public (*see* Stocks and Bonds).

The shareholders then hold a meeting and elect a *board of directors*. The number of votes each casts is proportionate to the number of shares he holds. The board of directors then appoints the president of the corporation and other executive officers. (In a small company, such as a retail store, the powers of the stockholders, board of directors, and president may all be held by a single individual.) The corporation may then set up a factory, buy machinery, hire a manager and workers, and start manufacturing. The profits go to the shareholders as *dividends*. The board of directors declares when a dividend should be paid and how much. At stated times, usually every year, the board calls a meeting of shareholders to vote on certain matters. But the shareholders have little part in running the business.

A corporation is regarded legally as a *person*. It may buy and sell property, and it may borrow money (by issuing bonds). But unlike a person it does not die. The original shareholders may all sell their stock, but the corporation goes on unless the business fails or the shareholders vote to dissolve it.

State laws control each class of corporation. Those that deal in interstate commerce or communications come under federal laws as well. Federal antitrust laws forbid industrial corporations to acquire monopolies (unless based on a patent) or to enter into agreements to fix prices (*see* Monopolies; Trusts). However, certain service corporations—such as telephone, gas, and electric companies—are granted monopolies by public franchise. They are called *public utilities* and are subject to strict government control (*see* Public Utilities). Insurance companies, investment trusts, and banks also come under special public supervision.

The idea of a corporate body as a continuing legal personality goes back to very ancient times. Roman law recognized corporate bodies distinct from the individuals comprising them. In the Middle Ages the church regarded monasteries and abbeys as "fictitious" persons that could own large estates, though each monk took an oath of poverty. The first corporation to issue stock was probably the Dutch East India Company in 1602. Its example was soon copied by the famous British East India Company. The Industrial Revolution, which demanded larger business units, stimulated the growth of joint-stock companies. Today giant corporations form the very center of industrial organization in the United States. They lead in technological research, and their wage scales and labor relations set standards for the nation.

CORPUS CHRISTI, TEX. The south Texas city of Corpus Christi owes its rapid growth to a fine harbor and to nearby farms, ranches, and oil wells. Corpus Christi Bay opens on the Gulf of Mexico, and the city stands on a 40- to 50-foot height of the south and western shores, 130 miles southeast of San Antonio. The bay is protected from Gulf storms by Padre and Mustang islands.

The city is the commercial and shipping center for 24 Texas counties and an all-year recreation area. Within 150 miles are some 13,000 wells that produce gas and hundreds of thousands of barrels of petroleum a day. The industries include oil refineries, cotton-seed, chemical, cement, and corn products plants, and

a zinc smelter. The farms and ranches of the area produce cotton, corn, winter truck crops, and dairy and beef cattle.

The Corpus Christi port annually ships some 9,000,000 tons. Much of this tonnage goes by ocean oil tanker and freighter; the balance goes by barge up the Intracoastal Waterway to the Mississippi River and thence on to the markets of the central states. Corpus Christi is the seat of Nueces County and the University of Corpus Christi. A great naval air station is close by.

The bay was visited and named Corpus Christi (Body of Christ) by Spaniards in the 16th century. An American trading post was built on the bay in 1839. The shallow harbor did not become a deep-water port until a Gulf storm destroyed Port Aransas on Mustang Island, in 1919. Federal aid was then won for dredging a 21-mile channel to Corpus Christi. The port was opened in 1926. In 1930 the area began to produce petroleum in commercial quantities. The city government is the council-manager form. Special government bodies include water and port authorities. Population (1950 census), 108,287.

CORSICA. The island of Corsica lies in the Mediterranean Sea directly south of Genoa, Italy. It is a department of France, but the people speak Italian. The French purchased it from Genoa in 1768—a year before the birth of Corsica's most famous son, Napoleon Bonaparte. The modest house where he was born still stands in Ajaccio, the capital, on the west coast. The largest city is Bastia, a port on the northeast coast.

The climate is balmy and the scenery is spectacular. Densely forested mountains cover the interior. Narrow white beaches edge the shore. The lower mountain slopes are covered with evergreen shrubs (called *maquis*). Tourists can smell the fragrance of them when still miles out at sea. Higher up grow chestnut trees, and still higher, pines.

Fishermen live in rough stone huts along the shore. A few miles back are peasant villages, built like fortresses for defense and clinging to rocky pinnacles. The peasants grow grapes and olives on the slopes and fruit in the valleys. They also raise sheep, cattle, and goats. Those who live still higher up in the mountains graze pigs on chestnuts and make bread of chestnut flour.

The Corsicans were long noted for their vendettas, or blood feuds. The French gradually brought order to the land and built roads, bridges, and schools. Area, 3,367 square miles; population (1946 census), 267,873.

CORTEZ (*kôr'tĕz*), **HERNANDO** (1485–1547). The Spanish soldier Cortez became the "conqueror of Mexico" largely because of his habit of doing unexpected things. As a boy he was quiet and modest in appearance but bold and unruly in action. His father, a poor nobleman living in the small town of Medellin in southwestern Spain, thought Hernando would make a good lawyer and sent him to study at Salamanca. But young Cortez was soon expelled from the university for disorderly conduct. Efforts to interest him in mining and stock raising also failed. What he wanted was a life of adventure.

America had been discovered when he was about seven years old. When he was about 18 he sailed for the island of Hispaniola, then the Spanish headquarters in the West Indies. There he had seven years' experience as a soldier. In 1511 he sailed under Diego Velásquez to help conquer Cuba. For his ability he was made *alcalde* (mayor-judge) of Santiago.

When Juan de Grijalva in 1518 reported his discovery of Mexico, Diego Velásquez picked Cortez as his deputy to establish a colony there. But the young officer went about his preparations in a way that made Velásquez suspect him of ambitions beyond his orders. Velásquez therefore canceled the expedition to Mexico.

Cortez, however, had been waiting too long for such a chance to give it up. He hurriedly assembled what men and equipment he could and set sail. With him were about 600 Spaniards, about 200 island Indians, and several cannon and horses. He rounded the peninsula of Yucatan and touched Mexico first on the coast of what is now the state of Tabasco.

Here he had a sharp battle with Indians. Only his horses and cannon enabled him to win. He took many captives, including a young woman to whom he gave the Spanish name Marina. She became devoted to him and acted as interpreter. Then he continued up the coast. On April 21, 1519, he landed near the site of Vera Cruz (*see* Vera Cruz). There, to prevent all thought of retreat, he burned his ships.

Leaving a small force on the coast, he led the remainder into the high mountainous interior. The change from tropical heat to bitter cold killed many. The warlike Tlaxcalans attacked—300 Indians to every Spaniard. After three separate battles, the vanquished Indians became allies of the Spaniards and thousands joined the Spanish force when it marched to Tenochtitlán, the Aztec capital (now Mexico City).

The Aztecs were uncertain how to treat the invaders. Were they ordinary enemies bent on conquest? Or were they messengers of the white god Quetzalcoatl? According to Aztec belief, this god had left Mexico ages ago with a promise to return. A detachment of Aztec warriors tried to stop the Spaniards on the road but were driven off. On Nov. 8, 1519, Cortez reached Tenochtitlán and was graciously received by Montezuma, the Aztec emperor. The visitors were amazed at the wealth and civilization they found. They also were horrified by the Aztec custom of offering human sacrifices to their gods (*see* Aztecs).

Scarcely had Cortez established headquarters in the capital when he learned the Aztecs had plundered Vera Cruz. Swiftly he seized Montezuma and forced him to surrender the attackers. The emperor, closely guarded, watched their execution at the palace gates.

Meanwhile Velásquez had sent a force of 1,400 soldiers under Pánfilo de Narváez to arrest Cortez and bring him back to Cuba. Cortez with only 265 of his men went to meet Narváez, defeated his army, and then

enlisted most of the survivors under his own banner He returned to the Aztec capital at the head of more than 1 600 Spanish soldiers and a host of Tlaxcalan warriors

He got back just in time The leader of the garrison Pedro de Alvarado fearing treachery had slaughtered 600 Mexican nobles at a religious festival As Cortez and his men reached the Spanish headquarters in the heart of the city they were attacked by thousands of Aztec warriors Many Spaniards were killed hundreds were wounded Montezuma brought from his prison to pacify his people was stoned by them so that he later died When Cortez asked the attackers to let him leave the city the Indians replied that not a single life would be spared To fight their way out was the Spaniards only hope The running battle lasted for days At the end when his broken army was surrounded and apparently doomed Cortez and three others hewed their way toward the chief tain of the Aztecs killed him and seized his banner Dismayed by this miracle the Aztecs withdrew With less than 500 of his men left alive Cortez in July 1520 made his way back to his Tlaxcalan allies

HERNANDO CORTEZ
Conqueror of Mexico

To the astonishment of his followers he refused to admit failure The Aztec capital was protected in great part by extensive lakes lagoons and canals So Cortez determined to return to the attack by water as well as by land To Martin López expert ship designer and builder fell the job of constructing 13 brigantines from Tlaxcalan forests Built 60 miles from water they were carried through the mountains in sections and reassembled They were launched the following April Cortez was able to recruit his forces by winning over a second detachment of Spaniards sent against him by Velásquez He now had 900 white soldiers and 50 000 Tlaxcalans

The end of May saw the siege of Tenochtitlán begun With their food and water supplies cut off the Aztecs subsisted on rain water and rats The ships fired incessantly upon the city House by house the city was wrecked and burned until only a quarter of it remained On August 13 1521 Guatemoc the new Aztec emperor surrendered So fell the great empire of the Aztecs Only 70 000 remained alive More than a quarter of a million had died in battle or from illness and starvation

The Spaniards ransacked what remained of the city but nowhere could they find Montezuma s treasure which they had seen a year before Furiously angry they poured oil on the feet of Guatemoc and ignited it Either he did not know its whereabouts or would not tell The treasure was never found

The next seven years Cortez spent in establishing peace among the Indians of Mexico and developing mines and farmlands In 1528 he went home and was received with great honor by Charles V But he had no gift for courtly politics When he returned to Mexico he went merely as a military commander He explored Lower California in 1534 35 and served as a volunteer against the pirates of Algiers in 1541 The same year he led an expedition against the Mayas of Yucatán He died near Seville Dec 2 1547 He was buried in Mexico but was moved several times The last internment was in the church of the Hospital of Jesus Nazareno which he had founded in Mexico City From 1823 to 1946 the casket was concealed in the walls to prevent desecration due to anti-Spanish feeling

COSMOS Each year the graceful cosmos a native of Mexico and tropical America becomes increasingly popular Its bright aster like flowers with their tall filmy leaved stems are as much desired for bouquets as in flower beds and the fact that its season of bloom comes in the fall when almost all other outdoor plants are through blooming adds greatly to its popularity The plants grow to a height of from three to six or even ten feet with red purple yellow or white flowers In recent years plant breeders have much improved the species increasing the flower from an inch or two to three or even four inches across and shortening the plant stem

Cosmos should be grown in rather sandy soil since a very rich loam tends to produce an overabundance of foliage and few flowers Seeds should be sown indoors in April then potted and transplanted when the frost time is definitely passed Unless so treated they do not flower early

Cosmos bipinnatus and *cosmos sulphureus* (yellow) are the species best known Black cosmos is a tender annual growing only 12 to 16 inches high

COS'SACKS Fighters farmers—these are the Cossacks one of the proudest peoples of Russia They are descended from pioneers and outlaws In the 15th century many Russians fled from serfdom and escaped to the islands and frontier lands of the Don the Dnieper and middle Ural rivers

They took the name Cossack from Kazakh a district near the Caspian Sea They formed three hosts or semi independent states each governed by an elected council and a *hetman* or headman With their reckless love of freedom and adventure they fought off the troops of the czars and looted caravans Unable to quell them Russian rulers decided to allot them land munitions and some supplies in return for military service as special cavalry troops

The Cossacks lived in villages and worked their land in common. They were the few who had some democracy in czaristic Russia. They paid very little taxes and gradually developed into a privileged class.

The Cossacks' record as special, crack cavalry for the czars was savage. Whenever the oppressed people gathered to plead for better living, wildly charging Cossacks galloped through the streets, slashing with leaded whips and sabers. Russians everywhere dreaded the alarm, "The Cossacks are coming!"

In the Russian revolution during World War I the Cossacks lost their privileges. They turned to farming and highly developed their rich grain and pasture lands. They also, however, kept their stern heritage of training for mounted warfare. In World War II they greatly helped to defend Russia and throw back the Nazi forces. Though many Cossack units were mechanized, most served as cavalry.

COSTA RICA. The beautiful little Central American republic of Costa Rica is unusual. Unlike other Latin American nations it has had few revolutions and wars. Costa Rica has very few pure-blooded Indians and relatively few meztisos. Nearly all its people are of pure Spanish ancestry. It has a high level of literacy—even most peasants can read and write.

With an area of 19,652 square miles Costa Rica is a little larger than Vermont and New Hampshire combined. It is a land of tropical coastal lowlands, cool mountains, and a central plateau of "eternal spring," where the temperature ranges from 59° to 77° F. The plateau, some 3,500 square miles in area, rises from 3,200 to 6,500 feet between the mountains.

Nearly all the people of Costa Rica live on the cool plateau, where the soil is rich with volcanic ash. Most of them own and work small farms. Rising from the plateau, near Cartago, is volcanic Mount Irazú, 11,260 feet high. From it, one can see the coastal jungles and both the Atlantic and Pacific oceans. The highest point in Costa Rica is Chirripo Grande, which rises to 12,533 feet.

The capital, San José, is on the plateau. It is a pleasant, clean city, lying on the Pan American Highway. Rail and air lines connect it with the ports of Limón, on the east, and Puntarenas and others on the west. The architecture is mostly Spanish colonial.

Costa Rica is proud of its learning. Education is free and compulsory from ages 7 to 14. Spanish is the national language; but required subjects include English. Since Costa Rica is an agricultural country it also requires agriculture courses for both boys and girls, even in city schools, where the pupils work school gardens. Geometry is taught in elementary schools. The University is at San José.

For home use, Costa Ricans grow rice, sugar, beans, potatoes, citrus fruit, pineapples, and tobacco, which are carried to market in brightly decorated oxcarts. They also have some dairy and cattle farms. They must, however, import much of their food. Their chief exports and chief source of income are coffee, bananas, cacao, and abacá. Until the 1930's nearly all banana plantations were on the Atlantic coast, and the fruit was shipped from Limón. "Panama blight" almost wiped out the fruit, and plantations were established on the Pacific lowlands. Two ports were built—Quepos and Golfito. About 75 per cent of Costa Rica is forested; some timber, chiefly cedar, is exported. Other exports include palm oil and gold.

Costa Rica has only light industries, such as processing coffee, and small-scale manufactures of consumer products, such as clothing. It has to import nearly all other manufactured articles. Costa Ricans hope to develop much more water power from their short, swift mountain rivers.

History and Government

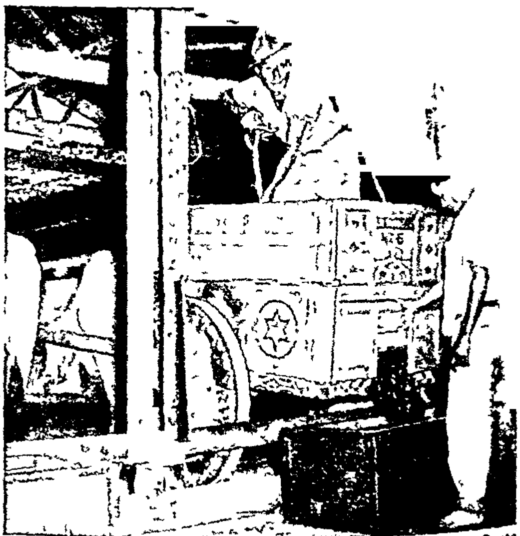
Costa Rica was discovered by Columbus, who landed on the site of present-day Limón, Sept. 18, 1502, on his last voyage to the New World. After centuries of distress under Spanish rule, it joined other colonies in revolt in 1821. In 1824 it joined the four other Central American nations to form the Republic of Central America. It withdrew in 1838.

In 1856 Costa Rica joined the Central American states in a war against William Walker, an American adventurer who sought to restore slavery in Central America. In 1857 Walker escaped and surrendered to the commander of an American sloop of war.

Costa Rican government generally has been stable. Boundary disputes with Panama and Nicaragua were settled by French and American arbitration.

The constitution dates from 1871, with many modifications. In 1948 it abolished the army in favor of a Civil Guard. As modified in 1949, the constitution provides for a president and a one-house legislature, each elected for four years. Both men and women vote. Roman Catholicism is the state religion, but there is full religious freedom. Population (1950 census), 800,875. (*See also* Central America.)

CHIEF CROP GOES TO MARKET



A planter shovels coffee from his oxcart into a bin at a Costa Rican *finca*. Oxcarts are the chief kind of transport. Each of the seven provinces has its own distinctive cart colors.

COTTON—*The World's* CHIEF FIBER

COTTON. We use cotton in some form every day. In summer we wear cotton clothes because they are cool and easy to clean. Through the year we enjoy cotton towels, sheets, rugs, draperies, gloves, and countless other cotton products ranging from sewing thread to cooking oils. The world uses more cotton than any other fiber. Despite the increasing use of synthetic fibers such as rayon and nylon, cotton still provides the world with over half its textiles.

The millions of people in India, Egypt, and China wear cotton the year around. Even in the bitter winters of northern China most people wear cotton coats padded with cotton. As the days grow colder, they simply add another padded coat, saying it is "two-coat weather" or "three-coat weather."

Some 60 nations grow the cotton plant. The chief producer is the United States. Until shortly after World War II the Southern states grew almost no cash crop except cotton. Southern farmers were so dependent on it that people called it King Cotton.

New Developments and New Regions

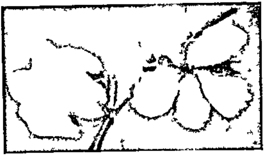
Today cotton is still the chief cash crop in the South, but many Southern farmers no longer put *all* their land into it. They are rotating and diversifying their crops. A vast new region, however, is now producing cotton—the Far West. Cotton farms still outnumber all others in the nation, and cotton ranks as one of the most valuable agricultural products in the nation—second only to corn.

The parts of our nation where cotton is grown is called the cotton belt. At one time this meant only the Southern states east of the Mississippi River. Today the belt stretches across the southern United States from the Atlantic coast to the Pacific.

The belt has four great regions: (1) Southeast—North and South Carolina, Georgia, and Alabama. (2) Mid-South—Mississippi, Louisiana, and Arkansas. (3) Southwest—Texas and Oklahoma. (4) Far West—New Mexico, Arizona, and California. The states which grow small amounts of cotton include Florida, Tennessee, Virginia, and Missouri.

How Cotton Is Grown

Growing methods vary with regions. In the semiarid Southwest and Far West cotton is irrigated. The dry, level plains and valleys there are suitable for heavy power machinery, and so planters profitably work very large farms which are highly mechanized. Most of their planting, cultivating, and harvesting is done with machinery. Elsewhere in the cotton belt fields are usually smaller, fenced, and ditched for drainage, and most of the work is done by hand. Some planters, however, are rebuilding their fields and cooperatively buying power machinery.



At the top is the lovely cotton flower. It resembles its relative the hollyhock. A fully open cotton boll with five locks is in center picture, right. At the bottom is the maturing plant.

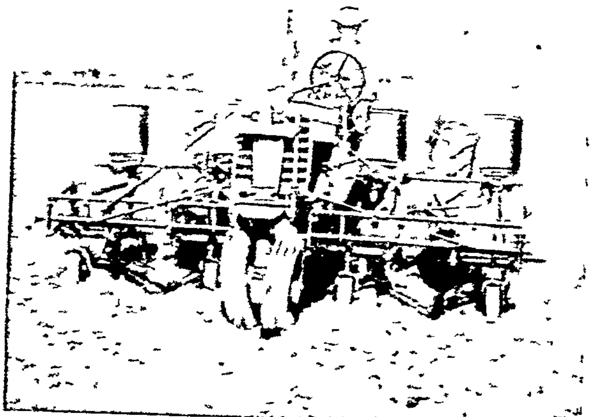
Cotton is a warm-climate crop. To develop fully the plant usually needs a growing season of 200 days free from frost. The cotton planting season ranges from March 1 in southern Texas to early June in northern parts of the belt. To get warmth from the sun the seeds are planted shallow, from one to two inches deep. Some farmers plant their seed in hills, some in furrows, and others in flat seed beds—especially where cotton farming is highly mechanized.

Planting and Cultivation

Mechanized planters are steadily increasing, but in the South there are still many mule-drawn planters

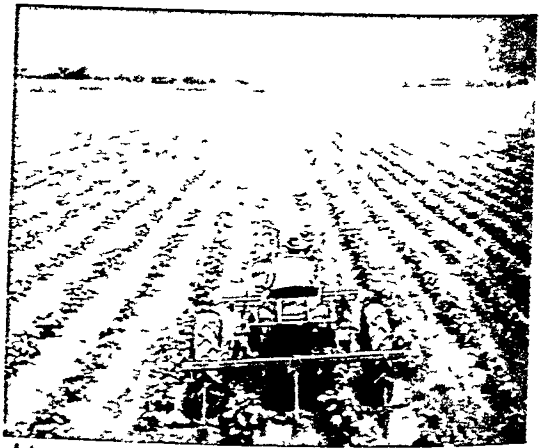
OLD WAYS SEE NEW WAYS ENTER THE "LAND OF COTTON"

A mule planter makes a furrow, drops the seeds, and covers them. One to two bushels are planted an acre. A good stand of cotton here varies from 15,000 to 20,000 plants an acre.



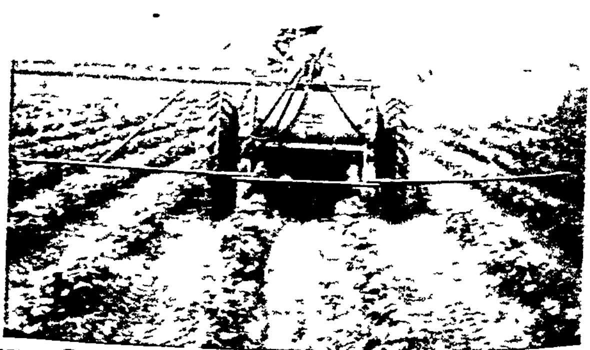
A four-row tractor mechanically plants seed. It can apply fertilizer simultaneously. On mechanized farms, a profitable stand of cotton varies from 50,000 to 60,000 plants an acre.

"Chopping," or "chopping out," by hand labor is a hot, tiring task, but it clears the weeds and grass better than mechanized thinning. Notice the young water boy in the foreground.



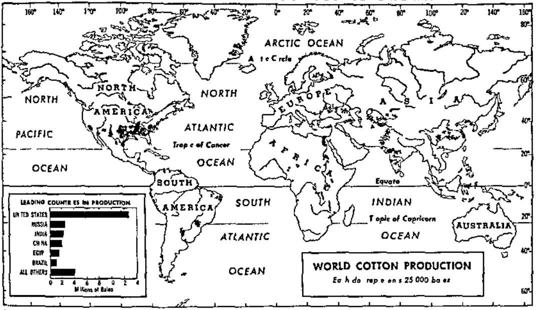
A two-row tractor stirs the soil to kill the weeds. The best way to kill weeds in a cotton field is to "get them" while still small. Farmers cannot relax their field cultivation.

A boll weevil here pierces a cotton boll with its beak to lay eggs in the hole. When the young hatch they eat their way into the boll. The mature weevil is only one fourth inch long.



To control the boll weevil and other insect pests, farmers spray insecticides with hand tanks or, as shown here, with a tractor tank. Boll weevils do three fourths of the insect damage.

WHERE THE WORLD'S COTTON IS GROWN



Almost all the world's cotton is grown between the equator and 37° north latitude. The notable exceptions are in Brazil and Russia. Cotton is grown farthest north in Russia. Several Latin American countries have the right soil and climate to grow large cotton crops but are handicapped by lack of labor and capital. (United States Department of Agriculture map.)

As young cotton plants are weak, the seed is sown thickly so the early plants can support each other. When the plants are from three to five inches tall they are thinned. On many farms men and women and even children trudge up and down the rows to chop out plants with hoes. This is "chopping." On mechanized farms planters use machines with rotary knives or flame throwers. As the plants grow, workers must cultivate to reduce weeds and grass. Some farmers cultivate the crop eight or nine times. Machine power cultivators are increasing. Some planters chemically treat the earth to control or reduce weeds.

To control insect pests, especially the dreaded boll weevil, the plants must be sprayed (*see* Weevils). Many employ airplanes to "dust" the plants, as one plane can treat as many as 1,500 acres a day.

About two months after planting, when the plant is about a foot high, it blossoms. Each bloom is creamy white. After a day it changes to red. That night or the next day the red petals fall, leaving a flattened green pod. This is the *cotton boll*.

The boll takes from 45 to 60 days to mature into an egg-shaped pod about an inch in diameter and from an inch to an inch and a half long. Inside are from three

ADAPTING CLIMATE TO COTTON AND IMPROVING STRAINS

Where rainfall is less than seven or eight inches in summer cotton must be irrigated as here near El Paso, Tex. All cotton land must be well drained to reduce action of harmful bacteria.

Here at Stoneville, Miss., the United States Department of Agriculture has an experimental station to test and improve varieties of cotton. Each row here is labeled.

MOST OF THE WORLD'S COTTON IS PICKED BY HAND

Men, women, and children trail long bags from their shoulders. When the bags are full of cotton, each empties his at a certain spot in the field for individual weighing. Work hours are short.

Plucking cotton from the boll (right) must be learned. Here a skilled picker plucks all the locks from two bolls at once. He is careful to get all the cotton and avoid leaves and burrs.

to five compartments, depending on the cotton variety, each with from seven to ten seeds—each seed sprouting about 10,000 fibers. When the boll splits, out bursts the fluffy white mass of fibers—cotton.

The cotton plant, however, does not ripen all at one time. Blossoms and open bolls may be seen on the same plant. This is because the branches with leaves shade the lower part of the plant. To speed ripening, many farmers *defoliate* the plant in the growing season—they use chemicals to make the leaves fall.

At harvest time, some cotton plants are three to four feet high. Some varieties, especially in the dry Western lands, are much shorter and pickers must stoop or crawl along the rows. Starting in the southernmost part of the belt, harvesting begins in July and lasts, in the northernmost part, into December.

Harvesting by Machine and by Hand

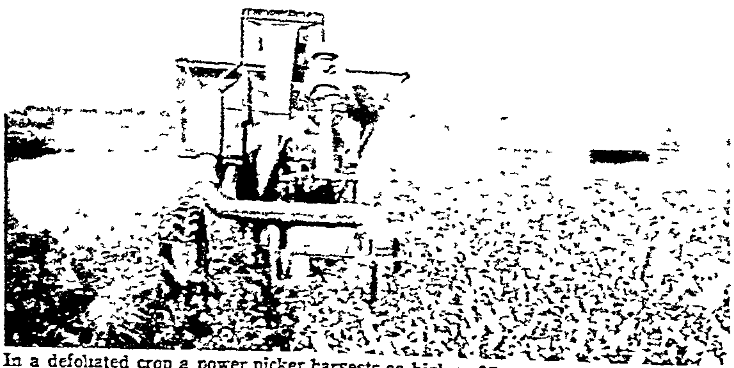
Today about 20 per cent of the cotton crop is harvested by machine. The two types of mechanical harvesters are the cotton *picker* and the cotton *stripper*. The picker pulls the cotton from the boll. It can harvest almost 650 pounds an hour where a man can pick only about 15 pounds an hour.

The stripper slices off the bolls, stems, and even part of the stalk. Strippers are chiefly used in the dry Western lands. A stripper can harvest as much cotton as 26 workers can by hand snapping the bolls.

Cotton is largely harvested by hand, especially in the South. There, fields are usually picked three times. Crews of pickers—men, women, and often children—either pluck the cotton cleanly from the boll or "hand snap" it—wrenching off the entire boll, husk and all. Snapping is much faster than plucking but produces cotton "trashy" with leaves, stems, and bits of burr.

Pickers are paid by the 100 pounds. Skilled, fast adult workers can pick about 300 pounds a day; but most adults pluck only about 200 pounds daily. Wages vary, depending on economic conditions, the market price of cotton, and labor supply. Before World War I pickers got as little as 40 cents per 100 pounds. During World War II some were paid as high as $5.

MECHANICAL PICKER AND A COTTON BUYER



In a defoliated crop a power picker harvests as high as 95 per cent of the bolls in good weather. Dryness lowers the harvest.

Right, a planter anxiously watches a buyer "pull" a sample from his cotton to see its grade (condition) and length of fiber.

Later the price dropped to about $2 then fluctuated Many farmers say the cost of hand picking is about one fourth the value of the cotton crop

Owner, Manager, and Tenant Farming

Today more and more Southern cotton farms are being operated by their owners or by managers They hire their labor Many, however are still operated by tenant farmers who share the crop with the owners instead of receiving wages

The tenant farmers are chiefly either *share tenants* or *sharecroppers* The share tenant provides labor, tools, animals, feed, seed and fertilizer He pays the owner from a fourth to a third of the crop The sharecropper is too poor to own equipment He can supply only his own labor and borrows the equipment from the owner or credit merchant at interest He gives half the crop to the owner His own share often is not enough to pay what he owes

To aid sharecroppers and share tenants Congress enacted the Farm Tenant Act of 1937 and the Farmers Home Administration Act of 1946 These provide loans to help tenant farmers buy their own land

Gins Separate Fiber and Seeds

Before cotton can be used, the fibers must be separated from the seeds Done by hand it takes a day to get a pound It was done this way till Eli Whitney invented the cotton gin in 1793 (*see* Whitney Eli)

Today in *motor-driven gins* hook-tooth saws tear the fibers from the seeds The free fibers called lint are sucked away to a press box

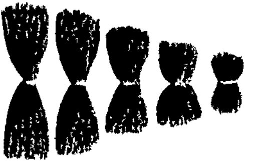
The seeds are saved—some for seeding next year's crop, others to make products worth millions of dollars a year Crushing mills squeeze from them tons of oil for a variety of products including cooking and salad oils, soap, margarine and cosmetics Products from the crushed seeds include linoleum, putty, cattle feed, insulation, medicines, and fertilizer Even *linters*, the fuzz that clings to the seeds after ginning are saved. They are used for such varied articles as X-ray films, plastics flare and cargo parachutes, and guncotton for ammunition

The cotton fibers are pressed into bales each weighing 478 pounds net and 500 pounds when wrapped in bagging and bound with steel strips Each is classed in one of nine grades set by the federal government Official spot markets are Charleston S C, Augusta and Atlanta, Ga, Montgomery, Ala New Orleans, La, Memphis, Tenn, Little Rock Ark and Dallas Houston, and Galveston, Tex Other cities, however, have organized *spot markets* The *future markets* are New York City, New Orleans, and Chicago

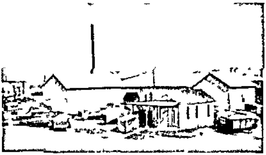
The World Cotton Crop

About a third of the cotton used in the United States goes to industry Clothing and household items each take about a third On a five-year average the world cotton crop usually totals some 28 312 000 bales a year The United States grows, on the average, about 13,400,000 bales a year—nearly five times as much as Soviet Russia, the second largest producer Other major growers are India, China Egypt, and Brazil Texas is the chief producing state

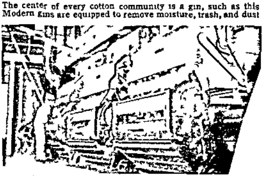
RAW COTTON GOES TO THE GIN



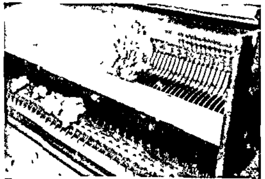
Left to right almost natural size, are sea-island Egyptian, upland long-staple upland short-staple, and Asiatic cotton



The center of every cotton community is a gin, such as this Modern gins are equipped to remove moisture, trash, and dust



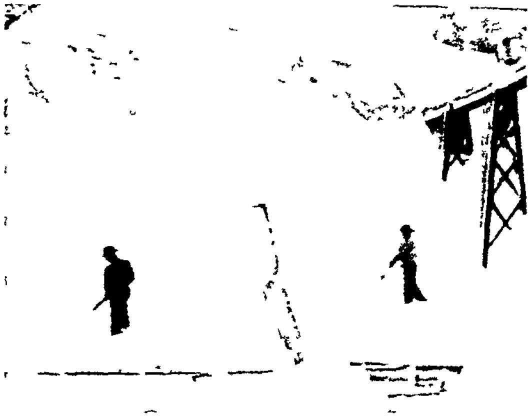
Up-to-date gins have from three to five "stands" like these A good gin gets all the valuable lint from clean-picked cotton



Here is a close-up of the circular steel saws They are usually 12 inches in diameter and revolve 600 750 times a minute

ON THEIR WAY TO THE MILLS—AND PROSPECTIVE BUYERS


The sides of the press box at the gin are opened to let the man tie the bale with jute and fasten it with steel straps.


Storage sheds at the crushing mills house enormous piles of cotton seed like this. Between the workers is a vertical air duct.


Cottonseed oil streams down as the employee pushes a pan of seed cake from the press in a co-operative oil mill in Texas.


Here in the "ring" of the New Orleans Cotton Exchange brokers buy and sell for customers. Note the quotation board at the top

Southern cotton mills manufacture about three fourths of the nation's cotton goods. With the raw material at hand and with cheaper labor, they have surpassed New England, the birthplace of American cotton manufacturing. The chief cotton manufacturing states are now South and North Carolina, Massachusetts, Georgia, Alabama, and Virginia.

Manufacturing the Cotton

At the mill, workers open the bales and loosen the fibers. Picking machines clean the blended cotton and make it into rolls, or *laps*. In the carding machine a cylinder with wire points straightens the tangled fibers into a thin web. This is drawn through a funnel, which molds it into a *sliver*, a ropelike strand about as thick as one's finger. For high quality yarn, the sliver is combed to remove short fibers.

A drawing frame draws out six slivers and combines them into a single strand about the size of the original sliver. A roving frame slightly twists and further draws out the cotton into a thinner strand. The rovings go to a spinning machine which repeatedly draws out and twists them into yarns of desired size and winds them on bobbins for weaving.

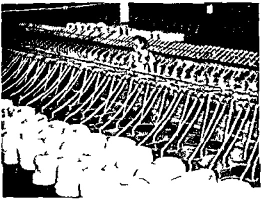
Weaving the Cotton into Cloth

There are two kinds of yarn. The yarn that runs lengthwise in a fabric is the *warp*. The crosswise yarn is the filling, or *weft*. The warp, which takes the strain, is given a higher degree of twist.

In a weaving loom the ends of the warp yarn are fastened to a roller. For weaving plain fabrics, every other warp thread is lifted, all at once; while the odd threads—first, third, fifth, and so on—are lowered. A shuttle drives the weft threads between the filling threads. Then the upper threads come down and the lower ones go up, and the shuttle drives back again. On one journey the shuttle lays the filling threads *under* the odd threads and *over* the even ones of the warp. On the way back, this is reversed. It can make 200 trips a minute. (*See also* Spinning and Weaving.)

The woven cotton is called "gray goods." Most mills do not process it into finished cloth. They

SPINNING AND WEAVING COTTON INTO CLOTH



Cans of sliver from drawing frames are being fed to slubbers or first roving frames They draw and slightly twist the cotton medium and fine yarns take two or three rovings

Cotton yarn is being worked on a weaving frame which makes it into cloth Modern American mills are the outgrowth of one built by Samuel Slater at Pawtucket R I in 1790

sell the gray goods to *converters* who prepare it for the market

Among the many processes in finishing are bleaching dyeing preshrinking and printing The finished cloth comes as more than 120 different fabrics ranging from denim and duck to batiste and chambray Special finishes include glazed chintz crepe water repellancy washable wall covering and mercerization (*see* Fabrics Mercerizing Textiles)

Cotton is also knitted Great machines turn out vast quantities of cotton underwear and sports wear (*see* Knitting Machines) Some cotton is also pressed into a web and bonded together into cheap paperlike fabrics such as disposable diapers

History of Cotton

The use of cotton goes back beyond the records of history As early as 3000 B C cotton was grown and used in the Indus Valley of India Ancient Egypt and China also spun and wove it

In the Middle Ages the Arabs brought the cotton plant from India to Spain They called it qutun from which comes the name cotton By the 11th century traders brought to Europe the filmy muslins of the East though growers of wool and flax tried to keep them out The name muslin comes from Mosul once a great cotton manufacturing city

The earliest explorers of the New World saw cotton growing in the West Indies Cortez found the Aztecs skilled in spinning weaving and dyeing Ancient mummies in Peru were wrapped in native cotton

History of Cotton in the United States

As early as 1607 planters in the Southeast grew small crops of cotton but hand picking the lint from the seed took so much labor that there was little profit Then in 1793 Eli Whitney invented the cotton gin This revolutionized Southern farming

Planters turned from tobacco and rice to cotton To supply the growing demands of mill owners in England and New England they imported more slaves to work the cotton fields The number soared from about 700 000 in 1793 to nearly 4 000 000 by 1860 Plantations sprang up in Alabama Mississippi Missouri Louisiana Tennessee and Arkansas By spreading slavery in the South cotton helped to bring on the Civil War (*see* Civil War American Reconstruction Period)

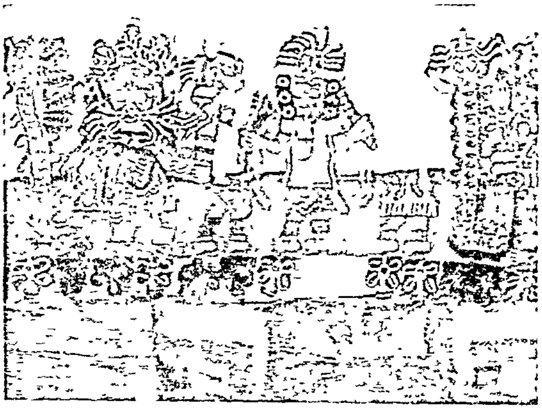
Before World War I the United States exported half its cotton crop Foreign production has so increased that now less than a quarter is exported Imports are small They consist chiefly of strong brownish Egyptian cotton for thread and rough Chinese fibers for mixing with wool for rugs and blankets

The Cotton Plant and Its Varieties

The single cotton fiber is a flattened twisted tube The twist helps the fibers to interlock when spun into strong threads The plant belongs to the mallow family It is a perennial and in its wild state may grow up to 15 feet high Cultivated however the seeds are planted each year to check pests and to keep the character of the fiber constant

INDIAN CARDING BY HAND

In India s villages cotton spinning and weaving are done by hand The worker fluffs the fibers by plucking the bow s string



ANCIENT TEXTILE FROM PERU
Found at Paracas, this cotton textile was woven about 300 B.C. It may contain some wool. It is in the Brooklyn Museum.

The many kinds of cotton fall into five general classes. *Sea-island cotton* (*Gossypium barbadense*), a native of tropical America, has the longest fibers, from $1\frac{1}{2}$ to 2 inches. Very little is now grown in the United States, but some is produced in Puerto Rico and in the Windward and Leeward islands. *Egyptian cotton* is related to sea-island cotton, with fibers from $1\frac{3}{16}$ to $1\frac{3}{4}$ inches long. A similar variety, *Pima*, is grown in Arizona. Most of the United States crop and about half the world crop is *upland short-staple cotton* (*Gossypium hirsutum*), with staples from $\frac{5}{8}$ to 1 inch long. *Upland long-staple cotton*, grown chiefly in the United States, is from $1\frac{1}{8}$ to $1\frac{3}{4}$ inches long. Asiatic cottons have strong, rather rough, short staples, often only $\frac{3}{8}$ to $\frac{3}{4}$ inch long. They are being replaced in some Asiatic countries by the American upland type. The scientific names are *Gossypium herbaceum, Gossypium indicum, Gossypium arboreum*. *Peruvian cotton* (*Gossypium peruvianum*) has a wiry lint which mixes well with wool. *Brazilian*, or *kidney, cotton* (*Gossypium braziliense*) has seeds that grow in a kidney-shaped mass. Its staple is from 1 to $1\frac{1}{4}$ inches.

Within the classes are many varieties. Some ripen early; some resist wilt; others resist storms. To keep the quality constant and make ginning more efficient many planters join in a "one-variety community," all growing the same variety. In California the law permits only the *Acala* variety of upland long-staple.

COUNTERFEITING. Making imitation coins or bills for use as real money is *counterfeiting*. It is a crime because it threatens the safety of a nation's money system (*see* Money). It has often been used to weaken a country at war. In 1812 Napoleon printed counterfeit money to circulate in his invasion of Russia.

United States laws forbid many apparently harmless acts, because they might help counterfeiting. It is illegal to alter or to mutilate a coin or a piece of paper money. Except with special permission, it is illegal to draw, paint, or photograph the face of any paper currency. To make or possess a mold of any coin or a metal plate engraved with the likeness of a bill is also against the law. Since 1951 it has been lawful to publish pictures of coins.

The law forbids anyone to keep counterfeit money in his possession. A counterfeit should be taken to the nearest post office. The United States Secret Service will investigate the case. The Secret Service publishes a booklet, 'Know Your Money', which shows how to tell counterfeits.

COUNTY. In 47 of our 48 states the largest division of local government is the *county*. In Louisiana it is called the *parish*. There are over 3,000 counties in the nation. Most states have from 60 to 100 counties. Delaware, however, has only 3; Texas, 254. In size, counties range from the 20,131 square miles in San Bernardino County, Calif., to 22 square miles in New York County, N. Y. The population varies from 52 persons in Armstrong County, S. D., to 4,508,792 in Cook County, Ill. (1950 census). Most counties in the nation have largely a rural population.

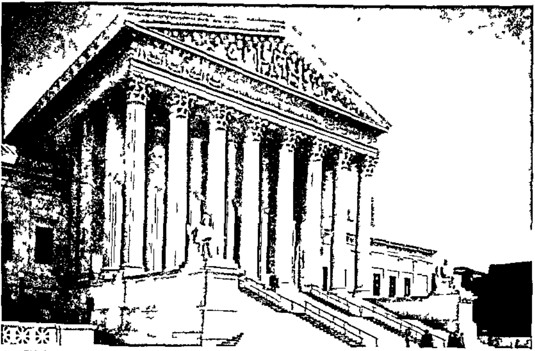
County boundaries are set by the state legislature. In most states, the constitution determines the kinds of county officials. In all states but Rhode Island, each county has a board of commissioners, or supervisors, usually elective. Their terms and numbers vary; but in most states the board has three to five members. Except in Rhode Island there are several other elective offices—such as sheriff, prosecuting attorney, judge, clerk, and coroner. There are also many appointive offices. In some counties these are under competitive civil service examination.

The work of most counties is extremely varied. The county board has charge of many institutions, such as the county poorhouse, hospital, and jail. It levies taxes and controls elections. It builds and maintains roads, bridges, and airports. The county clerk issues marriage licenses, birth and death certificates, and records land deeds. The probate court administers wills. The county grand jury indicts criminals and investigates charges of official misconduct.

A county superintendent of schools or a school board manages the school system. Many counties also have civil service and jury commissions, tax boards of review, architects, and surveyors.

This great number of county offices often leads to overlapping and confusion. To reduce such waste, some counties have cut the number of elective offices. These counties use a "short ballot," by which voters elect only a county board of commissioners. The board then employs a professional "county manager," who hires all other county officials except judges. Most state constitutions, however, block such reforms. They also prevent consolidation of counties. Instead, most states now take over considerable county work—such as road building—and make "grants-in-aid" to poorer counties.

The name "county" was given by the Norman conquerors of England to the old Anglo-Saxon shires, because in organization these political districts resembled those in Normandy ruled by counts. English colonists brought the name and unit to America.



This beautiful building bearing the legend Equal just ce under law is the home of the Supreme Court of the Un ted States the most powerful and independent court in the world It stands near the national Cap tol in Washington D C

Securing EQUAL JUSTICE *for* ALL

COURTS OF JUSTICE. To no one will we sell to no one will we refuse or delay right or justice These words from England s Magna Carta express the ideal of just ce for all one of the basic princi ples of democratic government To carry out this goal England the United States and other freedom loving nations have established *courts of justice* These inst tut ons may consist of a single judge or several judges s tting as a group (*en banc*) Their function is to decide disputes to interpret and apply the law to specific cases (The word court may mean the judge alone or the entire inst tution includ ing the judge and other officers of the court)

Courts of justice handle two major types of cases—*criminal* and *civil* In criminal cases courts enforce laws by trying and punishing offenders against the people represented by the state In civil cases they settle disputes between private citizens concern ing civil and property rights Both types of cases are first judged in *trial courts* These are courts with *original jurisdiction*—that is where cases are first brought to trial Sometimes the verd ct of a trial court may be appealed to a higher court known as a *court of appeals*

The Judicial Branch of Government

In the United States there are two court systems—federal and state In both systems the judicial branch of government is coequal with the executive and legislative branches and is independent of them (*see* United States Government) The federal system consists of the Supreme Court and inferior or lower courts The powers of federal courts are specified in the Constitution and by acts of Congress

Each state has its own separate system of courts All judicial authority not granted by law to federal courts is vested in state courts Thus state court systems are equal in rank with the federal system

The Federal System of Courts

The lowest courts of the federal system are the 86 United States district courts which have some 200 district judges These courts have original jurisdiction in all matters which involve federal laws and in certain cases which involve citizens of different states Next in rank are the courts of appeals in 11 circuits with some 65 circuit judges Circuit courts of appeals handle cases in which decisions of district courts have been appealed

The highest power admin stering justice in the United States is the Supreme Court This tribunal is the most powerful legal authority in the world It has the power to declare unconstitutional any act of Congress and any state statute thereby voiding such legislation This power of *judicial review* is not ex pressly granted in the Constitution It grew out of a decis on of the Court made in 1803 in the case of Marbury *v* Madison (*see* Marshall John United States Constitution) The Supreme Court has original jurisdiction in cases in which a state is involved,

and it may review cases from state or federal courts when a question of constitutional law is involved.

The Supreme Court consists of a chief justice and eight associate justices. Like all federal judges, they are appointed by the president and confirmed by the Senate. Federal judges hold office for life unless removed by impeachment. They may retire at 70 with full pay if they have served ten years.

The Supreme Court, the courts of appeals, and the district courts are called "constitutional courts" because they were created and organized under Article III of the Constitution. To aid in the administration of justice, Congress has created five United States "legislative" courts. They are:

Court of Claims, which determines the validity of certain kinds of claims against the nation.

Customs Court, which reviews appraisals and decisions of customs collectors.

Court of Customs and Patent Appeals, which reviews cases appealed from the Customs Court and the Patent Office.

Territorial Courts, which in general serve as both federal district courts and state courts within the various United States territories.

Court of Military Appeals, which reviews certain cases tried by military courts.

The Courts of the States

State courts are generally organized on the same lines as federal courts. They deal with most cases of crime arising within the state and settle civil disputes between citizens of that state. States vary widely in the names given to their courts but the system is much the same in all states. Courts of lowest jurisdiction are conducted by a *justice of the peace*. These officials try minor criminal and civil cases in rural areas and in small towns. They may "bind over" serious offenders to a grand jury. *Magistrate courts*, or *police courts*, try the same type of cases in villages and cities.

Next in rank are the *municipal courts* established in most of the larger cities. These courts help ease the burden of the next higher courts, the *general trial courts*, which have broad jurisdiction in civil and criminal cases. Such courts are usually known as circuit, county, district, common pleas, or superior courts. Above these courts many states have *appellate courts* that operate between the general trial courts and the state supreme court. At the top, each state has a *supreme*, or *high appellate, court*. Its decision is final except for cases which may be appealed to the Supreme Court in Washington, D. C.

Special branches of the state systems include such courts as conciliation (small claims), juvenile, probate, domestic relations, and claims (*see* Juvenile Courts). State judges are usually elected by the people and serve terms of from two to six years.

Courts-Martial and Other Court Systems

Courts-martial are military courts which try offenses against military law. They are important instruments for enforcing discipline in the armed services. Their composition and procedure are laid down in laws passed by Congress. When *martial law* is proclaimed in an emergency area even civilians may be subjected to courts-martial. (*See also* Habeas Corpus.)

The English court system was the forerunner of American and Canadian colonial courts. At the top were three *common law* courts (*see* Law). The King's (or Queen's) Bench, so named because the king originally was present in person, was a criminal court; the Court of Common Pleas handled civil cases; and the

A TYPICAL COURTROOM SCENE DURING A CRIMINAL TRIAL

The judge is sitting on the raised bench in the center. Directly in front of him is the court reporter who records the proceedings. At the right, the prosecuting, or state's, attorney addresses the 12-man jury. Behind him is the witness stand unoccupied. The defendant and his counsel sit at the left of the long center table, attorneys for the state to their right. At the far left newspaper reporters sit behind a table. Spectators occupy the seats in front of the long railing, or "bar."

HIGH LIGHTS IN THE HISTORY OF JUSTICE

At the left is an example of the harsh justice found in courts of the Middle Ages The steward of the district lord acts as judge advised by a council of notables The 16th-century engraving (center) shows the blindfolded classic figure of Justice illustrating impartiality The sword represents the strict administration of justice as fairly determined by the scales In pioneer America (right) judges rode the circuit from one county seat to another holding court wherever they could

Court of Exchequer revenue cases A court of equity known as Chancery tried cases in which the older common law did not apply

In 1873 these courts were grouped together as the High Court the Court of Appeals was added at the top The House of Lords serves as another appeal court although it is not as much used as formerly Especially qualified peers are appointed for life as law *lords* These lords also serve as the Judicial Committee of the Privy Council It deals principally with cases appealed from British colonies English judges are appointed for life and are free from personal or party influence

The court systems of other nations differ widely from those in England and the United States and offer varying degrees of protection for the accused The International Court of Justice at the Hague an organ of the United Nations tries international disputes (*See also* United Nations Hague Peace Conferences)

The Development of Courts

The need for judges to try disputes and to apply local laws and customs was recognized in earliest times The first judges were usually the oldest and most experienced men of the tribe the rulers or the priests Greece and Rome developed court systems which tended to be reasonable and just Among the Teutonic tribes that overthrew the Roman Empire disputes were settled by combat or by magic tests Medieval courts developed more orderly procedures but usually represented only the rights and privileges of the lords With the growth of free towns the king s courts began to uphold the rights of citizens against the nobles

The law in western Europe was based in part on Roman codes and in part on ancient customs and decisions that formed the common law Gradually courts especially in England gained more power and freedom from the influence of rulers By the middle 1660 s *the English common law courts had become champions* of a government of laws as opposed to a government of men Today all such democratic courts act as bulwarks of the people against tyranny

Court Procedures and Protection

An individual who believes he has been wronged by another may become the *plaintiff* in a civil suit by filing a *statement of claim* The clerk of the court then issues a *summons* commanding the defendant to appear in court on a certain day The sheriff or a deputy must serve this writ on the defendant who may file an *answer* or affidavit of defense If the complaint does not cover a legal cause of action the judge may uphold a *motion to strike* The case is then dismissed If there is ground for a suit the judge upholds a *motion for a bill of particulars* The issue has now been stated and the case goes to trial on a date set by the court calendar

At the trial the attorneys for each side call witnesses to offer evidence question and cross-question them and deliver arguments The judge or the jury if there is one in the case finds the facts and presents a verdict Damages may be assessed if the finding is for the plaintiff

In a criminal case an officer of the law arrests the person accused of crime on the authority of a *warrant* issued by a court At a preliminary hearing in a police or magistrate s court he may be held for investigation by a *grand jury* (*see* Jury) After an *indictment* by a grand jury the accused may be confined in jail or released on *bail* A *state s attorney* prosecutes the case in trial court When the accused cannot pay for legal advice defense counsel may be supplied by the state

The jury may bring in a verdict of *guilty* or *not guilty* If the defendant is guilty the judge pronounces sentence but the verdict may be appealed (*see* Prisons and Punishments) If the verdict is not guilty the defendant is *acquitted* and the Constitution forbids appeal (*double jeopardy clause*) A jury that cannot reach a decision is said to be *hung* and a new trial with a new jury may be ordered

A judge exercises great care in deciding what evidence the jury can properly consider. He will rule out evidence which tends to be unreliable, such as personal opinions and "hearsay." Opposing counsel may *object* to certain questions or points of evidence. The judge then *sustains* or *overrules* the objection. Such arguments and decisions are necessary for a controlled disclosure of facts In a criminal case the judge explains, in his closing *charge* to the jury, that a verdict of "guilty" must mean certainty "beyond a reasonable doubt." In a civil case, the finding needs only to agree with the "preponderance of evidence."

Throughout the trial the judge uses *precedents* to help him make decisions. He strives to be consistent with himself and with other courts, contemporary and past (*stare decisis*). This helps preserve the people's confidence in their courts. (*See* table of Legal Terms in Fact-Index.)

COVENTRY, ENGLAND. Its long past, crowded with incident and legend, combines with its modern industrial importance to make Coventry one of England's most interesting cities. Situated about 18 miles east of Birmingham, in the heart of the Midlands, it has ready access to raw materials and excellent transportation for its products. Automobile and electrical engineering industries are centered here. Important manufactures include airplanes, machine tools, bicycles, watches, ribbons, and some textiles.

According to tradition, Coventry was founded in the middle of the 11th century, when Earl Leofric established a Benedictine monastery there. Not long after, the story goes, his wife, Lady Godiva, interceded for the townsfolk on whom Leofric had levied a tax so heavy that they would starve if they paid it. Contemptuously the Earl agreed to remit the tax if Godiva would ride naked through the town at noonday. Godiva made this promise known to the people so that they should stay indoors behind drawn blinds. "Peeping Tom" ventured to look out and was struck blind.

The familiar phrase "send to Coventry," meaning to ostracize a person for objectionable conduct, probably came from an incident of the Puritan revolution against Charles I. Citizens of Birmingham captured some followers of the king and sent them to Coventry, which was strong for the revolution.

During the second World War, German bombers devastated the city. They destroyed the historic St. Michael's cathedral, except the beautiful spire, and demolished many picturesque half-timbered buildings dating from the 15th and 16th centuries. Temporary structures served until the city could be rebuilt. Population (1951 census, preliminary), 258,211.

THE COWPEA AND ITS PODS

Although it is called a pea, this plant is really a bean. Notice the long pods and the broad leaves.

COWPEA. What clover does for the North and the West in providing forage and enrichment of the soil, the cowpea does for the region south of the clover belt. All its parts are rich in nitrogen, and plowing it under enriches a field for succeeding crops It may be fed to animals as hay, silage, or pasturage. Its seeds are also highly nutritious.

The cowpea is more closely related to the bean than to the pea. It varies greatly in form, depending upon soil and climate Some varieties are erect or bushlike, others are trailing. The leaves resemble those of the common garden bean. The pods vary from five to ten inches and contain numerous roundish seeds Though it is grown chiefly in the South, some varieties are cultivated in the North. The "black-eye bean" is one of the several types of cowpea eaten by man.

The cowpea (*Vigna sinensis*) belongs to the family *Leguminosae* of the rose order (*Rosales*). It is a native of Asia and the Malayan region, but is now widely distributed throughout the world. It was brought from Europe to America in the 18th century.

COWPER, WILLIAM (1731–1800). Although thousands of people have laughed at his merry ballad of 'John Gilpin', the story of Cowper's life is a pathetic one. A shy, sensitive little lad, he lost his mother when he was six years old and was sent from the rectory in Berkamstead, Hertfordshire, where he was born, to a boarding school. Timid and homesick, he was persecuted by the older boys. He was afraid even to look at one bully of 15. He knew this lad by his shoe buckles and trembled at his approach.

Cowper could hardly have chosen a more unsuitable profession than the one for which he prepared. He studied law and was admitted to the bar. A clerkship in the House of Lords was opened to him, but he was terrified at the thought of the required examination. This mental strain, added to a natural tendency to melancholia, brought him to insanity. He attempted suicide and was confined in an asylum for many months.

On his recovery, feeling himself incapable of an active life, he withdrew to the country, where he was

tenderly cared for by devoted friends especially by Mrs Unwin the beloved "My Mary" of his poems A lover of nature and especially of animals Cowper passed many pleasant hours in walking through the fields gardening and caring for his pet hares However he lived always in the shadow of a great fear—the fear of a return of the insanity which finally did again overtake him

Cowper would probably never have written poetry had he not been urged to do so by his friends He followed Mrs Unwin s counsels like a child Believing it would occupy his mind she asked him to write poetry He did as she asked With the Rev John Newton he wrote the Olney Hymns some of which such as God Moves in a Mysterious Way are still found in the hymnals of today

WILLIAM COWPER

The author of John Gilpin was shy and sensitive

It was through the suggestion of another friend Lady Austen that he wrote his longest poem The Task She advised him to write something in blank verse Set me a subject then he said Oh you can write on anything take the sofa was her reply So he sang the sofa and the poem beginning in this way grew into The Task a rambling poem filled with reflections on many subjects The poem is relieved by touches of humor and charming bits of nature description It was Lady Austen too who told Cowper his story of John Gilpin In the poems are hints of deep love of nature and the joys of country life They foreshadowed the treatment of these subjects by such later poets as Burns and Wordsworth

COWSLIP The cowslip is a wild flower that blooms in early spring in England and other parts of Europe Its bright yellow blossoms are often mentioned by English poets The flower stalk grows to a height of six to eight inches from a rosette of dark green ovate leaves The rosette grows close to the ground The six to eight tubular shaped blossoms hang downward in a loose cluster from the top of the stalk The flower has five petallike sepals enclosing numerous stamens and pistils

The cowslip is one of the many species of primroses (*see* Primrose) Various primroses grow wild in the United States and there are many cultivated garden varieties but the true cowslip (*Primula veris*) has never become naturalized in the Western Hemisphere The marsh marigold and Virginia bluebell are sometimes called cowslips but they belong to different families

THE ENGLISH COWSLIP

The slender tubular yellow blossoms of the cowslip cluster at the top of a hairy stalk which rises from a rosette of rather coarse thick leaves

CRAB The crab is a shellfish It belongs to the class of crusty shelled creatures (*Crustacea*) closely related to the crawfish lobster and shrimp The crab is enclosed in a jointed shell *called a carapace It has five pairs* of walking legs The first pair form large pinching claws (*chelae*) In crabs that swim the last pair of legs are broad and flattened serving as paddles On the abdomen are one to four pairs of very small legs called swimmerets In some species they are used for swimming but usually the eggs of the female are attached to them

The eyes are mounted on movable stalks that can be drawn into the carapace There are two pairs of antennae The first pair are short and two branched, the second pair are long and single Behind the antennae are the jaws and mouth parts Crabs differ from the other crustaceans in having a small abdomen that is carried folded in a groove under the *cephalothorax* or united head and chest Crabs that live in water breathe by means of gills Land crabs have organs corresponding to lungs

Many different kinds of crabs live throughout the world They vary in size from the tiny pea crab which lives within the shell of the oyster and the mussel to the giant king or spider crab which may measure 10 to 12 feet from tip to tip of its claws and has a body as much as 18 inches long and 12 inches across

Most crabs live in the sea on or near the bottom The blue crab however swims very well and is often seen on the surface Some kinds like the fiddler sand rock and stone crabs live on the shore near the high water line or above and dig burrows in the sand Land crabs live several miles from water but return to the sea to lay their eggs One family of crabs found in southern Europe lives in fresh water The land and shore crabs move about by walking or crawling in a peculiar sidelong fashion which has given rise to the expression crabbing

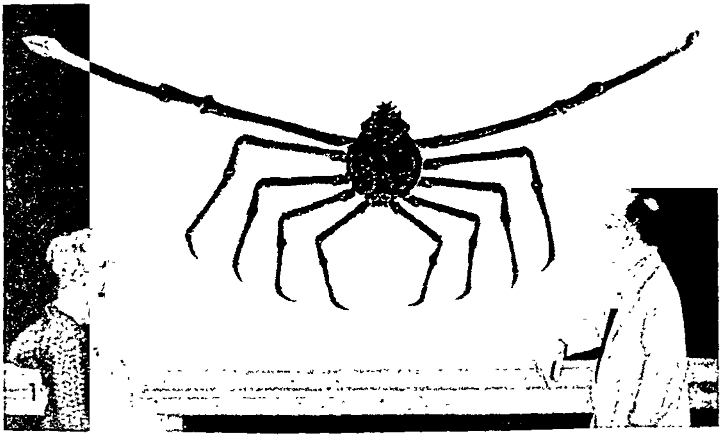
The fiddler crab is common along the Atlantic coast The male fiddler has an enlarged

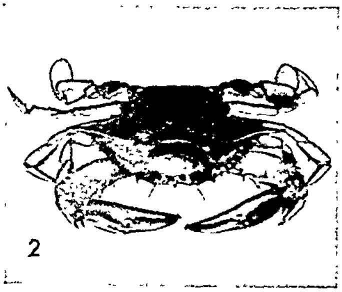
claw on the right one of its first pair of legs. It presents an odd sight as it scuttles sideways along the beach, brandishing the claw back and forth somewhat as a violinist moves his fiddle. It can burrow backward into the sand, and may use the claw for closing the opening to its burrow or as a weapon of defense. The fiddler hibernates in its burrow during the winter.

The tropical land crabs are remarkable for their annual spring migrations to the sea, in which the females lay their eggs. When the migratory instinct seizes them, they assemble in countless thousands, the males in the lead. Nothing stops them or makes them change their course.

Several kinds of sea creatures are called crabs, although they are not true crabs. The hermit crab has a long abdomen which is soft and spirally coiled. It thrusts the abdomen into the empty shell of a snail and holds onto it with the hooks on a pair of leglike organs. It walks about, dragging the shell behind it. As the crab grows in size, it moves into larger quarters. Often the snail shell is covered by a kind of sea animal that enlarges the shell by building up its open end. Thus the hermit is saved the necessity of moving. This is an example of *commensalism*—two animals living in cooperation with each other, and sharing the same food supply.

SOME CRABS OF DEEP SEA AND SHORE

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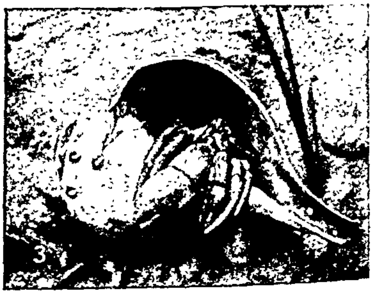
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4

The giant king crab, also called spider, or Japanese, crab (1) may span 12 feet between the tips of its claws. The blue crab of Chesapeake Bay (2) is one of the most important of the edible crabs. The hermit crab (3) lives in the empty house of other shellfish. It is not a true crab. The horseshoe crab (4), in spite of its heavy shell, is more closely related to spiders and scorpions than it is to crabs.

Closely related to the hermit crab is the coconut, or palm, crab of the Pacific Islands. It lives in holes in the ground and feeds on coconuts. It is believed to climb trees for coconuts. The horseshoe crab, also called king crab, is not a crustacean but is related to spiders and scorpions.

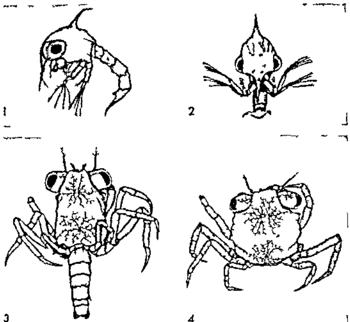
Some crabs feed on vegetable matter; others on smaller living animals; but most of them act as scavengers and devour dead or decaying material. Some forms live as commensals. The pea crab lives within the shell of the mussel and oyster and enjoys protection from its enemies. In turn it destroys organisms that might injure its host. Another crab carries in each of its claws a living sea anemone. This is an animal with stinging tentacles. The crab profits by the protection the tentacles give it, and the sea anemone finds food as the crab crawls about. The big sea crabs are usually covered with dense growths of seaweed and sponges, planted by the crabs themselves. Thus they are disguised from enemies.

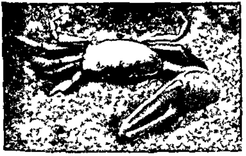
Crabs are striking examples of *metamorphosis;* that is, they pass through several entirely different stages in their development from egg to adult. The female lays eggs, but carries them on the legs of its abdomen until they hatch. Each egg hatches into a larva called a *zoea.* It looks totally unlike a crab. The large body has several long spines; the abdomen is long and narrow; the antennae, large and fringed; the eyes, enormous; and the mouth parts, with which it swims, greatly enlarged. The zoea of the fiddler crab molts four times over a period of a month. On the fifth molt it is in the second stage of development, called the *megalops.* The legs appear for the first time, but the abdomen is still long. In another series of molts, the mature crab finally emerges. A crab molts by pulling its body through a crack across the rear of the upper shell.

Commercial Crab Fisheries

Certain crabs are valued as food. They appear on the market either canned or fresh. The fresh crabs

METAMORPHOSIS OF A FIDDLER CRAB





The zoea is the larva of the crab When it first hatches from the egg it is about half a milli meter long Pictures 1 and 2 show side and front views 3 The zoea after five molts develops into the megalops Legs appear but the abdomen is still long 4 After about a month the megalops molts and the adult crab *emerges in its first stage* 5 Four or more molts take place before the crab looks like this fiddler with its great claw

may be either hard shelled or soft shelled The soft shelled are simply crabs that have shed their shell in the process of growth and the new skin has not yet hardened

There are three main species of crab meat Blue crabs are common on the Atlantic and Gulf coasts of the United States Dungeness crabs are taken exclusively on the Pacific coast of the United States King spider or Japanese crabs come from the North Pacific Ocean and Bering Sea Now commonly known as the king crab this species should not be confused with the horseshoe crab which is also known as the king crab The king or spider crab is the largest of the edible crabs producing as much as five pounds of meat Before the second World War the Japanese and Russians controlled the fisheries Since the war the United States has developed its own fisheries in Alaskan territorial waters King crabs are always canned They are caught by a fleet of trawlers and taken to a mother ship —a floating cannery where they are killed cleaned cooked and canned in a continuous packing operation

Various kinds of stone rock and sand crabs are gathered along the coasts for food but they are not important in the commercial fisheries

Scientific Classification

Crabs belong to the order *Decapoda* (meaning ten footed) of the class *Crustacea* in the phylum *Arthropoda* Scientific name of blue crab *Callinectes sapidus* dungeness crab *Cancer magister* king or spider crab *Paralithodes camtschatica* Fiddler crabs of which there are several species belong to the genus *Uca* hermit crabs and the palm crab to the genus *Pagurus* Horseshoe crabs belong to the class *Arachnoidea* scientific name *Limulus polyphemus*

CRACOW (*krā ko*) or **KRAKOW** (*kra kuf*) POLAND During the Middle Ages the ancient city of Cracow was the capital of Poland and a well known center of learning After Poland lost its independence Cracow s great university continued to be the center of Polish learning Today the Poles are under Russian domination and are denied the right to their traditional culture

Cracow is situated on both sides of the Vistula River about 155 miles southwest of Warsaw The river is navigable below the city and several rail lines intersect here The country around it is low and flat but a few miles to the south the great chain of the Carpathian Mountains rises along the border of Hungary The city serves a rich farming and mining area About eight miles to the southeast are the famous Wieliczka salt mines (*see* Salt) Zinc lead coal and other minerals are also obtained in the vicinity Cracow s chief manufactures are machinery agricultural implements and chemicals

The Medieval City

The core of the city is the ancient town Seven suburbs now surround it and the walls that once enclosed it have been leveled to form a wide parkway with walks gardens and chestnut trees The principal square is Rynek (market place) On it stand a Gothic church St Mary s and the Cloth Hall both built in the 13th century The main building of the university is a 19th-century Gothic structure The library built around a beautiful court is a jewel of medieval architecture In the court stands a

statue of the astronomer Copernicus, who studied here. Southwest of the old town on a rock hill (Wawel) stands the huge royal castle, once the residence of Polish kings. Near it is a 14th-century Gothic cathedral in which Poland's kings were crowned and buried. Other famous Poles, among them Kosciusko, are also buried here.

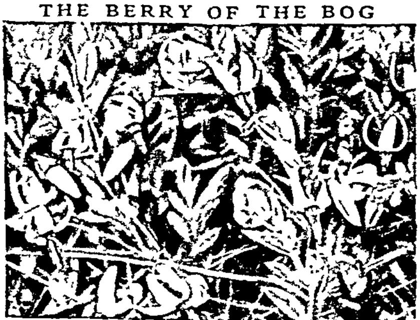
A legendary Slavic chieftain, Krak or Krakus, is supposed to have founded Cracow around the year 700. The city became the capital of Poland in the 14th century and its university achieved fame throughout Europe in the 15th and 16th centuries. In 1609 the court moved to Warsaw.

At various times, Cracow was ruled by Prussia and Russia before it passed to Austria in the third partition of Poland (1795). In 1815 the great powers made the small Cracow district an independent buffer state and called it the Republic of Cracow. The city passed again to Austria in 1846 and was joined to Galicia, a crownland of Austria-Hungary, from 1849 to 1918, when Poland became independent.

During the second World War, the German occupation forces made the city the seat of their government. The Russian army entered it in January 1945. It suffered almost no war damage. Population (1950 registration), 347,517.

CRANBERRY. American Indians first discovered that cranberries were good to eat with roasted wild turkeys. These ruby berries grew wild in swamps from Newfoundland to the Carolinas, and west as far as Wisconsin. Until 1810 no one had tried to grow them as a field crop. Even 40 years later, only a few Cape Cod farmers had learned to raise them successfully.

THE BERRY OF THE BOG



The trailing cranberry carpets the bogs with a mat of foliage. By fall its tiny rose-colored flowers (about life-size in picture) become shiny red berries.

The low bushes—about a foot high—have long, trailing branches and tough, woody stems. Blossoms appear in June. It is said that the pointed, oval pink bud hanging at the end of an inch-long stem reminded someone of a crane's head and neck. From this circumstance came the name *crane-berry*, later shortened to *cranberry*.

About two-thirds of the annual crop is raised in Massachusetts, where thousands of acres of otherwise useless swamps on Cape Cod produce one of the state's largest export crops. Wisconsin, New Jersey, Washington, and Oregon are also large producers.

The berries ripen by September or October. Those of the highest quality are picked by hand, but large rake scoops are used in harvesting most of the crop. In Wisconsin the cranberry bogs are flooded and the berries are scooped off as they float to the surface. The picking season lasts about six weeks, and an average yield is about 30 barrels an acre. Growers in a region often coöperate to handle the entire crop. The first cranberry coöperatives were organized in Wisconsin, but others now exist in New England and on the Pacific coast. Coöperatives grade the berries in screening sheds, store them in warehouses, operate canneries, and develop markets. The annual cranberry crop of the United States ranges from 400,000 to over 900,000 barrels in peak years. A large amount of these are canned as sauce or juice.

Preparing land for cranberry growing costs $300 to $500 an acre. After the peat bog has been cleared, a reservoir must be built to flood the bog whenever necessary to protect against frost and insects. Ditches are needed for drainage, and a deep layer of fine sand must be scattered to keep weeds down. Cranberry cuttings, set out in rows 12 to 15 inches apart, will bear a first crop in three to four years. In five years they will be in full bearing. A field once prepared needs little cultivation and almost no replanting.

Cranberries, as well as blueberries and huckleberries, belong to the heath family (*Ericaceae*). The familiar cultivated species, native to North America, are the large cranberry (*Vaccinium macrocarpum*), and the small cranberry (*Vaccinium oxycoccos*). The small cranberry is also found in Europe and Asia.

The cowberry (*Vaccinium vitis-idaea*) is sometimes called the "mountain cranberry." But it is not a true cranberry. It is found in northern Europe and Canada. It is also called foxberry, vineberry, and lingenberry.

CRANE. Through the still waters of open marsh lands the sandhill crane wades on stiltlike legs. His long neck erect, he scans the countryside with keen eyes for signs of danger. Then he lowers his head and searches the water. Out darts his neck, and his long daggerlike beak holds a frog or a salamander, which he swallows in one or two gulps. At other times he seems to prefer dry land and can be seen striding across fields, catching lizards, mice, and grasshoppers, or making a meal of corn and other grains.

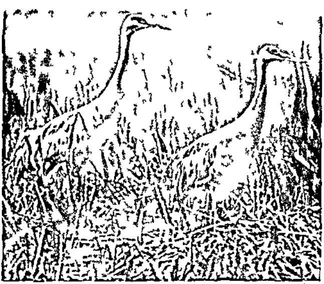
Among the wariest of birds, he detects the faintest sound or sight of danger. With a few long running strides, he takes slowly to the air, flapping his wings in a lazy rhythm. He always flies with his neck and legs stretched out in line with his body so that he resembles a great flying cross. At the same time he utters a booming tremulous call that can be heard long after he has flown out of sight.

This haunting, trumpetlike voice is produced in a remarkable windpipe, the first part of which is coiled and twisted like a hunting horn within the keel of the breastbone. From the lungs to the throat this windpipe may be fully five feet long.

In spring, the male cranes bow and strut before the females in a strange dance of courtship (for illustration, *see* Birds). A female lays only two or (rarely) three eggs a season in a nest that is often a mere depression in the ground, lined with grass

and weed stems On hatching the young are fully clothed with down and can run about in a few hours By fall they can take their place with the adults behind the trumpeting leader on the long southward flight in single file or in V formation.

FLORIDA CRANES STANDING AT ATTENTION



These wary birds are Florida cranes a variety of the sandhill crane The marshland is their home peninsula Florida southern Alabama and Louisiana and the Okefenokee Swamp of Georgia The tops of their heads are covered with a reddish and warty skin Their plumage is a brownish gray

Cranes are often mistaken for herons (*see* Herons) Though resembling herons outwardly, cranes are built more like their closer relatives the rails and the coots The crane has compact plumage and the hind toe lies above the level of the three front toes But the heron has fluffy plumage, and the hind toe is on the same level as the front toes The crane flies with neck out straight the heron, with neck curved The crane divides its time between land and water, but the heron is rarely found away from the water s edge

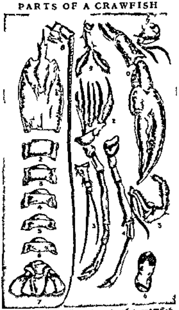
Cranes form the family *Gruidae* Of the 18 known species two are North American The sandhill crane (*Grus canadensis*) is slate-gray with a red face and stands three and one-half to four feet tall It breeds from northeastern California Wisconsin and Michigan to southern Canada and winters in the Gulf states and Mexico There are two subspecies of the sandhill crane the Florida crane and the little brown crane The latter nests as far north as Alaska Long threatened with extinction by man s destruction of its breeding grounds the sandhill crane now trumpets in areas that have not known its voice for 50 years Its return is a triumph of conservation education.

Less fortunate is its magnificent cousin the whooping crane (*Grus americana*) now one of the rarest of North American birds A white bird with red cap and face it grows five feet tall It breeds in the southern Mackenzie River region and northern Saskatchewan and winters in Texas

The European crane (*Megalornis grus*) an ashy gray bird with blackish throat and face, grows about four feet tall About the same size is the crowned crane (*Balearica pavonina*) of Africa The head is topped with a high tuft of yellow feathers Australia s native companion" (*Antigone rubicunda*) called brolga by the aborigines is a large gray crane with a red patch on the back of its head This friendly bird follows plowmen after insects

CRAWFISH The crawfish (also called crayfish) is related to the crab shrimp and prawn and closely resembles the lobster in general appearance It has been used as food all over Europe for many centuries, and in France where it attains a large size it is extensively bred

PARTS OF A CRAWFISH



Here are the different parts of a crawfish The segments of the body and the fan like tail (1 to 7) antenna (8) swimmeret 9) cheliped (claw foot) (10) maxillipeds (foot jaws) (11 and 15 , gills (12) antennule (small antenna) (13) walking leg (14) eye on eyestalk (16)

The crawfish lives in fresh-water ponds lakes and streams and often burrows in the soft earth of their banks It feeds upon insects snails tadpoles and other animals and devours dead or decaying organisms

The body is covered with a hard horny shell of *chitin* incrusted with lime The shell is jointed and is thick and hard between the joints but the covering of the joints is thin and flexible so that the hinder part of the body, or abdomen can be folded like a roll of paper The tail is jointed and resembles an open fan It is used with a forward thrust to shoot the crawfish backward through the water The rounded eyes are on short movable stalks and each eye patch is composed of hundreds of simple eyes.

Just behind the eyestalks are the antennae or feelers—two long ones and two short ones these are considered to be organs of touch The mouth is under and in front of

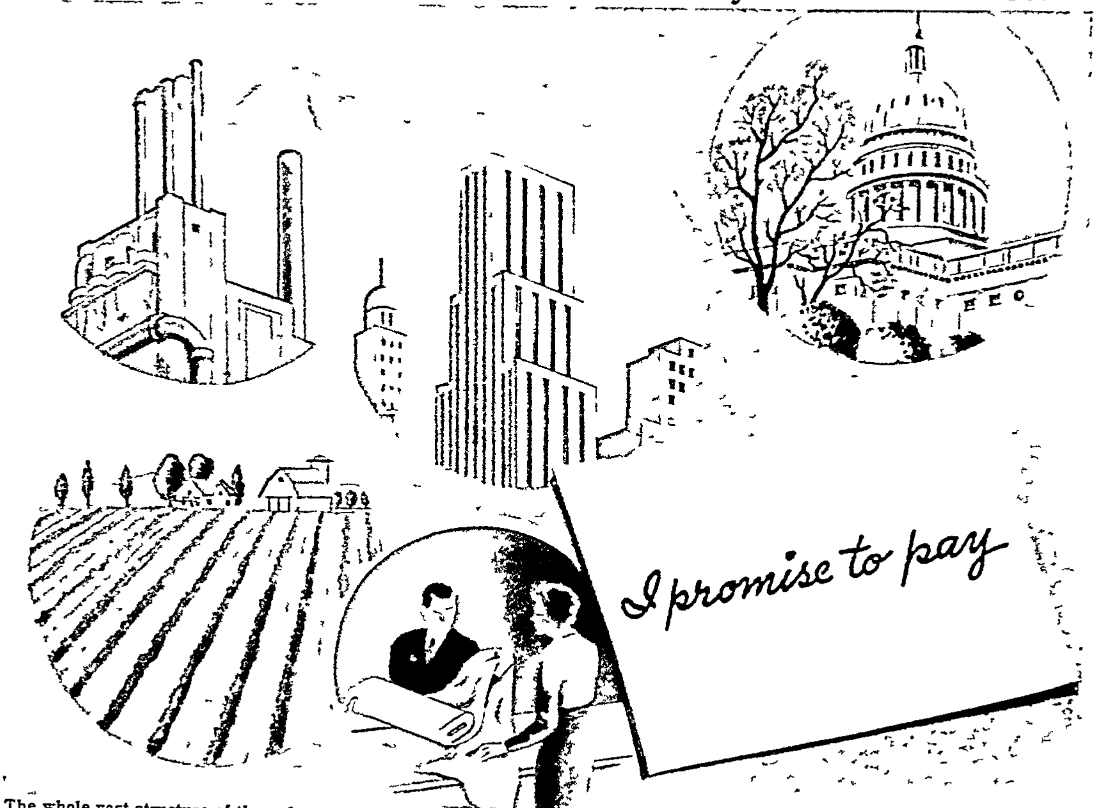
the base of the feelers, here are the jaws and five other pairs of mouthpieces which assist in biting or holding food Six pairs of jointed swimmerets are attached to the abdomen.

The eggs are attached to the swimmerets of the female and carried for several weeks till they hatch. For some time after hatching the young cling to the mother. At first each looks like a little round white ball. Later the ball becomes oval, with curious pouches on its surface, then this changes to a creature with a big head, short tail, and prominent eyes. Later a shell forms which is molted or shed as the animal grows, until the adult stage is reached. After the first year the shell is molted and renewed annually.

Several species of blind crawfishes live in caves, one species being found in the Mammoth Cave, Kentucky. There are crawfishes in South America but none in Africa, although one species is found on the island of Madagascar. They are absent in most parts of Asia, but are found in Australia and New Zealand, where some forms attain a large size and are used for food.

Scientific name of European genus (also found on the Pacific coast of North America), *Astacus*, of American genus (east of the Sierra Nevada Mountains), *Cambarus*

CREDIT—*the* LIFE-BLOOD *of* COMMERCE



The whole vast structure of the industrial world today rests upon credit. Manufacturing, transportation, commerce, farming, home building—none of these could exist on a modern scale without credit. What does that credit rest upon? We usually think of banks and other great financial institutions as its foundation. But in the last analysis, all credit depends upon the integrity of the average man when he speaks or signs his name under the simple words, "I promise to pay."

CREDIT. If you buy a week's supply of food at the grocery store and tell the clerk to "charge it to my account" you are buying goods on credit. If instead, you give him a *check* for the amount, you are using the commonest form of "credit instrument." If you spend a large amount, say several hundred dollars, for new furniture, you may give a check for only part of the amount, but give one or more *notes* for the balance, thus using another form of credit instrument. If you wish to buy a house and lot, you may still use a check for the first payment, and give the seller a *mortgage* to secure the payment of the balance; the mortgage is evidence of your indebtedness and the holder of it has a claim or lien against the property.

The word "credit" came from the Latin *credere*, which means "to believe or trust." Credit, therefore, has been defined as "belief in the truth of a statement, or in the sincerity of a person." In business transactions, credit means confidence that men will take care of their future obligations. Business men speak of *credit ratings* to indicate the degree of confidence in which a man is held. The common expression A-1,

denoting excellence, was the symbol used by Lloyd's of London for the best wooden ships

In business the essence of a credit transaction is that goods or money are delivered against a promise to return them or their equivalent value in the future

Credit is the life-blood of commerce and Credit is the heart and core of the modern business structure ' are statements frequently heard Without credit great business corporations would be impossible for no one man could supply all the capital needed for them Nor would there be enough money in the world to carry on the ordinary business transactions It is estimated that 50 to 60 per cent of the retail trade and more than 90 per cent of the wholesale trade of the United States are settled by checks drafts and other credit instruments The whole machinery of banking including the use of bank notes as money is based on credit in its various forms (*see* Banks and Banking)

Credit Instruments Defined

In its simplest form, namely, the purchase of goods against an expressed or implied promise to pay the use of credit involves no credit instruments The householder who makes his daily purchases from butcher and grocer, and pays his accounts later is using *book credit* sometimes he is said to be buying on *open account* But if he uses a written agreement or contract of any kind, he is using a *credit instrument* As a result of the gradual spread of credit in modern business almost all forms of credit instruments are negotiable either by custom or by statute The terms negotiable paper and credit instrument are not however interchangeable A credit instrument such as a note, may be drawn in such a way that it is not negotiable, it may be payable only to the payee, without giving him the right to transfer his claim

To be negotiable, a contract must be transferable by delivery or by indorsement and must be enforceable by the new holder, without notice to the original maker Under the laws of most states, negotiable paper is restricted to contracts which represent money or perform the functions of money A warehouse receipt for a thousand bushels of wheat may be assigned and may be the basis of credit, but it is not a negotiable instrument The law says that the mere possession of a warehouse receipt is no proof of ownership of the goods described The holder must be able to prove his title, in other words, the finder of a warehouse receipt has no legal claim to the goods On the contrary the finder or thief who holds a check or note in proper form though his own title is not valid may pass a valid title to a new and innocent holder

A check (also spelled cheque) like all other forms of negotiable paper, may pass through the hands of several owners either by delivery if it is made payable to bearer, or by ' indorsement " if payable to an individual The word indorsement comes from the Latin *in* meaning ' in or "on and *dorsum* meaning 'back ' The payee the person to whom the check is payable, signs his name on the back of the check, at the left or upper end, thereby assigning his rights to the money it specifies If he signs merely his name, it is a blank indorsement' , if he wishes payment made to a particular person, he may write Pay to the order of John Jones, and sign his name directly below, this is called ' indorsement in full ' or ' restrictive indorsement Checks may be indorsed "For deposit" or ' For deposit to my account," followed by the signature, such checks are no longer negotiable, and must be credited to the account of the payee by his bank There is no legal restriction on the number of indorsers Each indorser releases his rights to the money but he also assumes thereby a full liability for the amount to the next holder

Bills of Exchange or Drafts

A check is legally defined as a bill of exchange drawn on a bank and payable on demand Bills of exchange arose out of the needs of foreign trade in the Middle Ages (*see* Foreign Exchange) In its simplest form a bill of exchange is an unconditional order in writing addressed to a person or corporation ordering him or it to pay a sum of money on demand or at a certain time specified A ' domestic" or ' inland bill is the same as a foreign bill except that it is drawn and payable within the same country In ordinary business use the term ' bill of exchange ' has been replaced by the word ' draft ' or ' draught "

The drawee (the person who is asked to pay) is under no obligation until he has accepted the draft in writing usually by writing on the face of the bill his name the date and the word ' accepted " By accepting the draft the drawee promises to pay the amount and the draft is thereafter negotiable Sometimes drafts particularly those arising out of the sale of goods, are called ' acceptances ' or "trade acceptances "

Notes drafts bills of exchange, and acceptances are all popularly described as commercial paper In a strict sense this grouping is incorrect, in banking this term is restricted to such negotiable instruments as arise out of commercial transactions A note given to cover a speculation in real estate or in the stock market is not commercial paper in the banking sense In the United States the federal reserve banks make this distinction (*see* Federal Reserve System)

Drafts or acceptances accepted by a bank are known as ' bank acceptances ' They may arise in various ways For example, a shoe manufacturer sells a carload of shoes to a retail merchant and draws on him for payment in 60 days The retailer makes definite arrangements with his bank for payment of the draft at maturity, perhaps out of funds which he already has on deposit with the bank, or out of funds which the bank will lend him In either case, the bank accepts the draft thereby obligating itself to make the payment The manufacturer can now discount the bank acceptance at his own bank more readily than if it had been merely accepted by the merchant Bank acceptances are used mostly to finance foreign trade

A letter of credit is still another form of draft, but instead of specifying an amount to be paid, it sets a maximum not to be exceeded It is an order from a

bank or banker, addressed to one or more correspondents in the same country or abroad, instructing them to make payment to the holder of the letter upon proper identification. Each payment is noted on the letter, so that any banker may see at a glance how much has been paid against the total credit. Letters of credit, used chiefly by travelers, are not negotiable; payments may be made only to the person named on presentation of the letter. The purchaser arranges so that his bank will be reimbursed for the amount he draws against the letter. Usually the customer leaves money on deposit, but he may arrange a loan to cover money drawn, the loan to be repaid when he returns.

Travelers checks are really a form of letter of credit. They were originated by express companies for the convenience of travelers using small amounts, but are now commonly issued by banks as well. The buyer writes his name on the cover which holds the coupons; when he cashes each coupon, he must sign it in the presence of the correspondent. Banks usually charge a small fee for issuing letters of credit and travelers checks.

Credit Instruments Based on Promises

All the credit instruments so far mentioned represent one group; they are all *orders* of some kind, all derived from the draft. The other large group of credit instruments represents *promises;* they are all derived from the ordinary promissory note (*see* Percentage and Interest). A promissory note may be indorsed, and is then negotiable. Notes issued by governments, or by banks under government supervision, require no indorsement; presumably their credit is better than the credit of any individual. Almost all kinds of paper money are promissory notes. The face of the United States one dollar silver certificate, for example, certifies "that there has been deposited in the treasury of the United States of America one silver dollar *payable to the bearer on demand.*" (*See* Money.)

Simple promissory notes have no security other than the good faith of the borrower. Frequently notes are secured by the deposit of property as collateral. The holder of the note then has a legal claim, called *lien*, against the property until the note is paid; and, if the note is not paid as provided, he may take steps to acquire possession of the property. Collateral notes are the same as collateral bonds except that they are payable in a shorter time. In fact, all notes represent loans of comparatively short duration. Bonds, on the other hand, are for longer terms. Ordinarily bonds are secured by property, although government bonds and certain others may be unsecured. A mortgage bond, secured by a claim on land, buildings, railroads, or other specific physical property, is the highest type of corporate bond. Debentures, or debenture bonds, usually are not secured by a lien on any specific property. (*See also* Stocks and Bonds; Coöperative Societies; Installment Buying.)

CRE'OSOTE. In American countries most railroad ties are made of wood preserved by treating it with creosote oil, or "dead" oil. This is called "creosoting." This colorless or brownish oil is a product obtained in distilling wood, coal, or shale. Coal-tar creosote is used to preserve railroad ties, telephone and telegraph poles, and other woods exposed to the weather. The wood is placed in airtight tanks, and the oil, heated until it is a heavy vapor, is introduced; the vacuum and heat drive out all the moisture in the wood and saturate it with the oil. Disinfectants and animal dips also are made of creosote oil, and heavier creosote can be used in oil-burning engines. Creosote from beechwood is valuable in dentistry and medicine, especially in lung diseases. Creosote is used to preserve meats, and so gets its name from the Greek words "meat preserver." The wood smoke used to "smoke" hams and bacon in the old "smoke-houses" derived some preserving value from creosote.

THE CRADLE OF A LOST CULTURE

These ruins of the palace of King Minos on the island of Crete are among the remains of the ancient city of Cnossus. They stand near the north shore of the island close to the modern city of Candia.

CRETE. The rugged island of Crete, in the eastern Mediterranean, was the seat of an ancient culture and one of the steppingstones by which the arts and sciences of Egypt and Asia passed over to Europe (*see* Aegean Civilization). Excavators have uncovered ruins, telling the story of the wealthy, powerful, and highly developed civilization that arose there nearly 5,000 years ago. At the ancient capital, Cnossus (Knossus), they have laid bare the remains of the great palace of King Minos, which are so intricate and vast as to suggest an explanation of the legend of the labyrinth in which the Minotaur was imprisoned.

Crete 160 miles long and from 7 to 35 miles wide is the fourth largest island of the Mediterranean. A high chain of mountains, snow-crested for much of the year, forms the backbone, falling away in gradual slopes on the northern side, and on the south break ing in precipitous cliffs to a rocky shore. In the center rises Mount Psiloriti (8 000 feet), the ancient Mount Ida where Zeus, according to one Greek legend, was born. Numerous springs water the valleys, which would be highly productive if the agriculture were of any but the rudest sort. Vines and groves of olive, lemon and orange trees are grown on the lower hills and lowlands.

The Cretan people are primitive and mostly illiterate. Centuries of warfare have left them more backward than their remote ancestors. Under the rule of the Turks most of them became Moslems but today about two thirds of the island's inhabitants are of the Greek Orthodox faith. The Moslems still predominate in Canea (Khanai), the capital, and in Candia (Herakleion), an important trading city with a new and modernized port. The manufacture of toilet preparations and the export of garden products and oils are the principal industries.

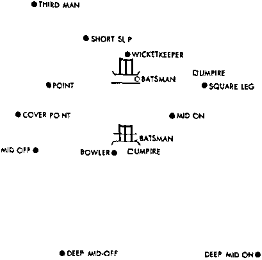
Greek invaders overthrew the early Aegean civilization before 1000 B.C. After the breakup of the Roman Empire the island passed to the Saracens and became a nest of pirates. Reconquered by the Byzantine, or East Roman, Empire in 960, it became a part of the spoil of the Venetians in 1204, during the Fourth Crusade. In 1669, after a 20 years' siege—the longest in modern history, in which 150 000 men were killed or wounded—the Turks took Candia and the whole island.

From that day almost until the present, insurrection followed insurrection and the Christian and Moslem population were often fighting each other. In 1913 as a result of the Balkan Wars, Turkey ceded Crete to Greece. In 1941, after the conquest of the Greek mainland, German parachute troops spectacularly invaded the island in the face of British defenses. Germany held Crete until the war ended. Population (1951 census) 462 124. (*See also* World War, Second.)

CRICKET. The national game of the British is cricket just as baseball is the national game in the United States. In Great Britain and in the British colonies boys learn to play the game as soon as they can hold a bat. Every school, college and university has cricket teams and later the professionals provide interest for cricket "fans." Cricket is also played by many big amateur clubs.

The cricket field consists of a wide stretch of turf, larger than a baseball park. In the middle of the field are two "wickets," 22 yards apart and facing each other. A wicket consists of three "stumps" (round straight pieces of wood) of equal thickness, standing upright 27 to 28 inches out of the ground. The distance between the two outer stumps is eight to nine inches, the third being midway between. Lying loosely in grooves across the top of the stumps are two pieces of wood called "bails," each four to

PLAYING POSITIONS FOR CRICKET



All fielding positions except the wicketkeeper and bowler are named according to the defensive areas occupied by the players. Positions vary according to the bowler and the type of bowling. Here the black dots show positions for slow bowling.

four and one-half inches long. A whitewashed "crease," eight feet eight inches long, is drawn on the turf in line with the wickets. This is called the "bowling crease." A similar line, the "popping crease," is drawn four feet from the wicket and parallel to the bowling crease. These two lines correspond to the batter's box in baseball.

The bat used in cricket is usually made of willow. Its length is limited to 38 inches, but 36 inches is the usual size. It has a handle 14 inches long, made of spliced cane, and a flat blade $4\frac{1}{4}$ inches wide and 22 inches long. Its weight varies between $2\frac{1}{4}$ and $2\frac{1}{2}$ pounds. The ball is made with a core of cork, around which are wound layers of fine twine and thin cork shavings until the proper size is reached. A cover of heavy red leather is sewed on with six parallel seams. The ball, about the size of a baseball, must weigh not less than $5\frac{1}{2}$ ounces nor more than $5\frac{3}{4}$ ounces and must be not less than 9 inches nor more than $9\frac{1}{4}$ inches in circumference.

The game is played by two teams, each consisting of 11 men. Substitutions can be made only for injured players. The captains "toss up" for innings and the winning side has the choice of batting or fielding first. Two men are always at bat at the same time, one at each wicket. The batters, or "strikers," must keep one foot between the bowling crease and the popping crease.

The "bowler" corresponds to the pitcher in baseball. He "bowls" by releasing the ball after taking a short run from behind the bowling crease at the opposing wicket. Bowling differs from pitching in that the arm must be kept straight when raised above the shoulder—the ball must not be thrown. The object of the bowler is to hit the opposite wicket with the ball after it has bounced once off the ground in front of

the wicket. The batter's object is to protect his wicket by striking the ball out of the way or by letting it glance off his bat out into the field. There are no "foul lines" in cricket and the fielders are scattered around on all four sides of the wickets. After the bowler has pitched six times, the umpire calls "over," and another bowler at the opposite wicket takes the ball and pitches in the reverse direction, while the second batter defends his wicket.

Runs are scored when a batter at one wicket strikes the ball and exchanges places with the other batter, each exchange counting a run. The most runs allowed from one hit, however, are six. A batter is out (1) if the bowler hits the wicket with the ball and dislodges a bail; (2) if the ball, after it is struck by a batter, is caught by any fielder before it touches the ground; (3) if a batter gets outside the popping crease and the wicketkeeper, who corresponds to the catcher in baseball, knocks off a bail with the ball or with the hand holding the ball; (4) if a batter stops with his legs or body a ball which in the judgment of the umpire would have struck the wicket; (5) if a batter knocks a bail from the wicket while batting; (6) if a bail is knocked off the wicket by any fielder who holds the ball, while the two batters are trying to make a run. In the last case, the batter who is nearest the wicket where a bail is knocked off is out.

"Extra runs" are counted by the umpire if the bowler throws the ball beyond the reach of the batter, or if the bowler gets outside the bowling crease, or if he jerks or throws the ball in an overhand pitch. Runs may also be scored if the wicketkeeper fails to stop a ball, letting the batters exchange places.

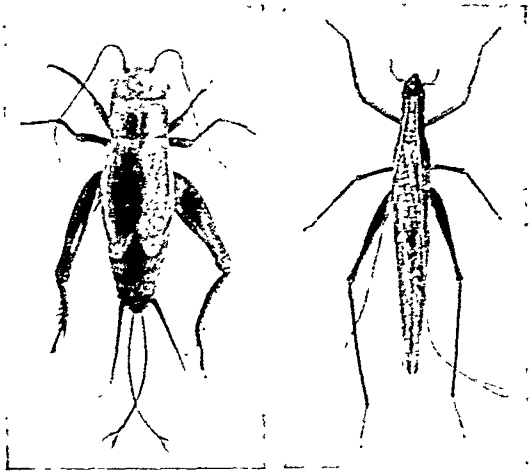
Each team stays at bat until ten men are out, the eleventh man having no partner at the opposite wicket. The game usually consists of two innings for each team, which sometimes makes a match last for three days, piling up enormous scores.

Although cricket is generally considered by Americans a much slower game than baseball, it calls for long training and great skill, especially in batting and bowling. Expert bowlers produce the same effect as a "curve" by giving the ball a twist so that it "breaks" when it strikes the ground. Greater accuracy is said to be required for bowling than for pitching in baseball. Batting in cricket also gives more opportunity for "placing" the ball, since the field on all sides of the batter is "fair ground." No player wears gloves in cricket except the wicketkeeper and the batter.

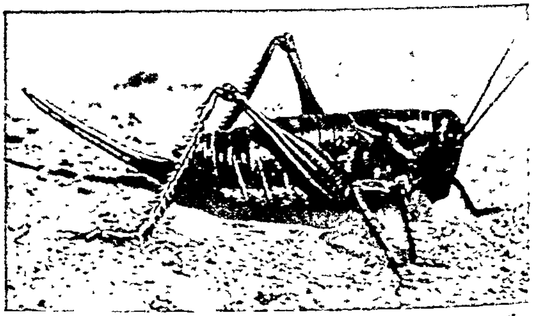
CRICKET. The cheerful chirp of these insects is so pleasant to most people that the expression "as merry as a cricket" has become a proverb. In his famous story 'The Cricket on the Hearth', the novelist Charles Dickens makes the plot center about a cricket who sings when things are going smoothly and is silent in times of trouble. The Chinese believe it is a creature of good omen and predict wealth for the house with many crickets.

There are several different kinds of crickets. Most of them do not fly. Hard, shiny wing covers lie across the back. Under them are a pair of tiny, useless wings which have lost their power for flight though the insects are extremely quick and lively. With their long hind legs they can jump considerable distances, and they scoot through grass and weeds with amazing speed. The antennae are long and slender.

FIELD, TREE, AND MORMON CRICKETS



The field cricket (left) is the familiar black insect that sometimes invades houses and chews holes in clothing. This is a female. The slender-bodied tree cricket (right), with its pale green coloring, is almost invisible, but its song is one of the loudest and most persistent of all insect concerts.



This is a female Mormon cricket. The spearlike organ at the end of the body is the ovipositor, by which it lays eggs deep in the ground. Mormon crickets are very destructive of crops.

The straw-colored house cricket of Dickens' story is a European insect. It has been introduced into the eastern United States. The common field cricket is found throughout the United States and southern Canada. It is black, about an inch long, with antennae longer than the body. It feeds chiefly on plant foliage but will eat other small insects, and it has a fondness for starched clothing. During the summer it lives in sunny fields. Under a clod of earth or a stone it digs a burrow with a small chamber at the end. Here it takes shelter when it is not foraging for food. It loves warmth and if it can find a cozy corner by the stove or fireplace it will spend the winter in a house. Most adult crickets die in the autumn, however, after the female has deposited her eggs in the ground. The eggs hatch the following

summer. The young, known as nymphs, resemble the adults but they do not have wings. They grow to adult size in a series of molts. The males are quarrelsome especially during the mating season. They strike with their antennae and leap at each other's heels biting furiously.

The familiar song of the cricket is produced by the male who scrapes the roughened surfaces of the wing covers against each other (for illustration *see* Insects). The female field cricket cannot sing but she is a good listener. The "ears" are located on the inside of the front legs.

The little brown field crickets, only half an inch long, are even more numerous than the black crickets. Their habits are similar. The snowy tree crickets are a delicate light-green color. Unlike the field and house crickets they live in elevated positions in high bushes and trees. They feed on aphids, scale insects and decaying plant tissue. The females lay their eggs in the bark of twigs causing considerable damage to the plant.

Although the tree cricket is seldom seen, its song is one of the most familiar of night sounds in late summer and fall. It consists of a monotonous high pitched *treat-treat-treat* repeated indefinitely. The female has no auditory organs to hear this concert. She is attracted to the male by the odor of a gland which exudes a liquid as he sings. Both field and tree crickets vary the speed of their chirps with the temperature. An amusing game is to estimate the temperature of a summer evening by using the following formula for the tree crickets: accurately count the number of chirps per minute, divide by 4 and add 40.

Crickets make interesting pets. Plant grass or clover in a flowerpot and then press a lamp chimney into the soil. Drop in one male cricket and one or more females and cover the top of the lamp with mosquito netting. Pulpy fruit, lettuce and crumbs of moist bread will keep the prisoners well fed.

One kind of cricket, less than a quarter of an inch long, lives in ant nests. It feeds by cleaning the bodies of the ants and the walls of their galleries. Besides the true crickets there are other insects called crickets. The mole crickets look and act much like tiny black moles. They are covered with fine short hairs. Their forelegs are broadened, turned sideways and *furnished with digging claws*. They live underground in wet fields. At night they leave their burrows and fly about. The black western or Mormon crickets, also called western grasshoppers, are more closely related to katydids. They live in the western United States. At times they do great damage to crops. They were the insects that almost destroyed the crops of the pioneer Mormons in Utah before gulls consumed the pests.

Crickets are members of the order *Orthoptera* to which grasshoppers and roaches also belong. True crickets belong to the family *Gryllidae*. The scientific name of the house cricket is *Gryllus domesticus*, field cricket, *Gryllus assimilis*, brown field cricket, *Nemobius palustris*, snowy tree cricket, *Oecanthus niveus*, ant-loving cricket, *Myrmecophila pergandei*. Mole crickets belong to the family *Gryllotalpidae*, Mormon crickets to the family *Tettigoniidae*.

CRIMEA (*krī-mē a*). From the south coast of Russia the Crimean peninsula juts into the Black Sea. It is almost completely surrounded by water because the Perekop Isthmus which joins it to the mainland is only three to five miles wide. In the east the peninsula curves around the Sea of Azov, an arm of the Black Sea. (For map *see* Russia.)

Dry level steppes, a continuation of the steppes of the southern Ukraine, cover three quarters of the Crimea. South of the steppes rise the Crimean Mountains. The highest ridge, about 4 500 feet, drops steeply to the Black Sea shielding the narrow coast from cold north winds. The climate here is subtropical. Sanitariums and rest homes, some of which were once czarist palaces, line the southern shore.

The largest cities are Simferopol in the center of the peninsula, Sevastopol on the southwest coast, an important naval base, and Kerch in the east.

On the south coast socialist state farms produce fruit and tobacco. Sheep are raised in the mountains. On the steppes wheat, cotton and tobacco are grown. A poor grade of iron ore is mined around Kerch. The chief industry in the towns is fruit canning.

The Crimea was for centuries the home of the Tatars (*see* Tatars). In World War II the Soviet government accused the Tatars of aiding the German invasion forces. After the war, in 1945, the government deported large groups of Tatars to Siberia and central Asia. It also reduced the Crimea from an autonomous republic to an oblast (region) of the Russian Republic. The government brought in thousands of Ukrainians to replace the exiled Tatars. In 1954 the Crimea was made part of the Ukrainian Republic.

The Tatars lost their independence to the Turks in the 15th century. Russia annexed the peninsula in 1783 and in 1826 built the Sevastopol fortress. The first famous siege of this fortress took place in the Crimean War (*see* Crimean War). In the second World War the Germans overran most of the Crimea late in 1941 but Sevastopol held out until July 1, 1942. Soviet armies entered it again in May 1944. In February 1945, before the war ended, the Allies held a historic conference at the Crimean seaside resort of Yalta. Area, 10 000 square miles; population (1947 estimate), 1 050 000. (*See also* World War, Second; Russia.)

CRIMEAN WAR (1854–1856). In 1853 Czar Nicholas I of Russia demanded the right to protect all Christians in Turkish territory. Actually his purpose was to extend Russia's influence over the Turkish Balkans and into Turkey itself (*see* Balkan Peninsula). As a first step the czar's troops occupied that part of the Turkish Balkans north of the Danube River that is now known as Rumania.

The Turkish sultan, counting on the support of Great Britain and France, refused the czar's demands. Great Britain feared its route to India would be cut

off if Russia took Constantinople. Napoleon III, emperor of France, was anxious to show that he was the true successor to his uncle, Napoleon I. War finally began in March 1854. By August, Turkey, with the help of Britain, France, and Sardinia, had driven the Russian forces out of the Balkans.

In order to bring the war to a decisive end, the allied fleets proceeded to the Crimean peninsula (*see* Crimea). There their troops landed (Sept. 16, 1854) and laid siege to the Russian fortress of Sevastopol. Severe battles were fought in the Crimea at Alma, at Balaklava (immortalized in Tennyson's poem 'The Charge of the Light Brigade'), and at Inkerman. During the siege of Sevastopol disease took a dreadful toll of French and British troops. Florence Nightingale's heroic work as head of the hospital service did much to improve conditions (*see* Nightingale, Florence). Not until Septembei 1855 was the smoking ruin of Sevastopol in allied hands.

In 1856 the powers signed a treaty at Paris. The new czar, Alexander II, withdrew all claims to Balkan territory. The Black Sea was neutralized. Turkey was admitted to the family of European powers, the sultan promising to treat his Christian subjects according to the public law of Europe. At the peace conference the powers agreed also to the Declaration of Paris abolishing privateering on the sea and allowing trade in neutral goods in time of war, barring, of course, contraband of war.

The Crimean War and the peace that followed it did little to settle the Balkan problem. The sultan soon proved unwilling to treat the Christians as he had promised, and Russia took the first opportunity of resuming its advance to the south.

DAVY CROCKETT—PIONEER *and* POLITICIAN

CROCKETT, DAVID (1786–1836). In history and in folklore Davy Crockett stands for the spirit of the American frontier. As a young man he was a crafty Indian fighter and hunter. For many years he was nationally known as a political representative of the frontier. He served two terms in the Tennessee legislature and three terms as a representative in Congress. When he was 49 years old he died a hero's death at the Alamo, helping Texas win independence from Mexico.

In addition to his real achievements, Crockett is the hero of many fanciful stories. He started some of them himself, because he loved to tell "tall stories." Other tales were started by his political supporters. In Crockett's day everyone admired a man who could kill bears or debate in Congress with equal skill. The American people enjoyed all the Crockett stories, real or imaginary.

Even as a congressman in Washington, Davy Crockett dressed as a frontiersman in moccasins and fringed buckskin clothes.

Boyhood in the Tennessee Wilderness

David Crockett was born on Aug. 17, 1786, in the eastern part of what is now Tennessee. His father was a Revolutionary War veteran, and Davy was the fifth son. When the boy was about seven, a spring flood washed away his father's gristmill. The family moved to Jefferson County, and John Crockett opened a log-cabin tavern.

In all pioneer families the children had to work as soon as they were able. When Davy was 12 his father hired him out to a Dutch settler who was moving back to Virginia. Davy's job was to drive the livestock over the 400-mile route. When they arrived, the Dutchman persuaded Davy to stay and work for him; but Davy became homesick and ran away. He joined a wagoner carrying goods west and arrived home safely.

The next fall Davy started school; but after only four days he had a fight with a fellow student. Fearing the schoolmaster and his father would punish him for fighting, he ran away. He got a job helping drive cattle to Virginia. In Virginia he worked for farmers, wagoners, and a hatmaker. After two and a half years, he returned home. He had grown so tall that his family did not recognize him.

Young Man of the Canebrakes

Davy was now nearly 15 and approaching six feet in height. He was very strong. In those days a boy either worked for his father or turned over his pay to him if he worked for someone else. Davy's father promised him freedom from this obligation if Davy would work a year for men to whom his father owed money.

After Davy worked off these debts, he continued with his last employer, a Quaker. He often borrowed the Quaker's rifle, and he soon became an expert marksman. From his wages he bought new clothes, a horse, and a rifle of his own. He began to take part in the local frolics and shooting contests. Neighbors would gather to help a family build a cabin or shed, and a frolic usually followed. The dancing would sometimes last all night. The prizes at the shooting contests were quarters of beef. A contest-

ant would pay 25 cents for a single shot at the target and the best shot won the quarter of beef Davy s aim became so good that more than once he won all four quarters of beef

The son of Davy s employer conducted a school near by For six months Davy went to school four days a week and worked two Except for the four days of school he had attended when he was 12 this was all the schooling that Davy ever had

Crockett Strikes Out for Himself

By the time he was 18 Davy Crockett was fully grown Neighbors liked the friendly young man and continued to call him Davy He fell in love with an Irish girl named Polly Finley and they were married Polly was a good frontier wife She could milk a cow tend the kitchen garden spin thread weave cloth sew garments and cook the game that Davy brought home from hunting

The bride s family gave the young couple two cows with calves Davy s Quaker employer gave them an order on a merchant for $15 Davy already owned an old horse and two colts He rented a farm and built rude furniture for their log cabin

Their attempt at farming did not pay well and Davy began to feel crowded by the people who had settled in the neighborhood After several years he moved his family now including two sons to Lincoln County He cleared the canebrake from a few acres and built a cabin Here the Crocketts lived for two years

Farming did not take all Davy s time In the tavern a few miles away he won a reputation as a storyteller His skill with the rifle kept his family well supplied with turkey deer and bear meat In 1810 Davy again became restless He set up a new homestead for his family on Beans Creek in Franklin County about ten miles south of Winchester Tenn

Scout and Indian Fighter

In 1812 war broke out between the United States and Great Britain The Creek Indians believing the British would aid them went on the warpath On Aug 30 1813 they captured Fort Mims in Alabama and killed the settlers who had sought safety there The Tennesseans were aroused With other frontiersmen Davy Crockett volunteered for 60 days service under Andrew Jackson He helped burn and capture Indian towns On Dec 7 1813 he fought in the battle of Taledego where 17 white men and 400 Indians were killed

At the end of the 60-day period Crockett returned to Tennessee But he stayed only long enough to rest his horse let his wife and children see he was well, and secure his winter clothing He rejoined Jackson s army as a member of a company of scouts. After a year of active scouting he returned home But when he heard that the Americans would attack the British at Pensacola he rejoined the army Pensacola was taken before he got there After some further scouting service he went home

WINNING VOTES WITH STUMP SPEECHES

In political campaigns Crockett toured his district and spoke from convenient tree stump platforms The voters laughed at his stories and agreed with the man with his ideas on government

Crockett Enters Politics

Crockett s wife died leaving him with two sons and a baby daughter In the neighborhood lived Elizabeth Patton a widow with two small children Davy and Elizabeth soon married and joined their two households Not long afterward Crockett moved his family to a new home on Shoal Creek 80 miles west of Winchester

A neighbor who had served as an officer under Jackson persuaded Crockett to support him for election as colonel of the state militia In turn he promised to support Crockett for major Before the election Crockett learned that the man was actually backing his own son for major He declared that in that case he wouldn t run against the son for major but against the daddy for colonel Crockett won the election easily and thereafter he was addressed as Colonel Crockett

At his homestead on Shoal Creek Crockett built a grist mill a powder mill and a distillery These cost about $3 000 and he had to borrow most of the money Not long after they were finished Crockett was persuaded to run for the state legislature He

spoke at barbecues and frolics during the campaign, telling homely jokes and stories. The frontiersmen liked him and he won the election.

The Last Crockett Homestead

While Crockett was attending the sessions of the legislature in 1822 a spring flood washed away his mills and distillery. He paid as much as he could of the money he owed and moved westward again. This time he settled in northwestern Tennessee, on the Obion River, not far from the Mississippi. His nearest neighbor was seven miles away. Large and small game animals were plentiful. During the first hunting season Davy shot 105 bears.

In 1823 he ran again for the legislature from this new district and was elected. In this campaign Crockett, before an audience of voters, told his opponent: "I'm gonna have me a huntin' shirt made for the electioneerin'. It'll be a buckskin shirt fringed mighty purty and have two big pockets, each o' 'em big enough to hold a peck. In one I'll tote a gallon of whisky. In t'other I'll tote a big twist o' tobaccer. When I offer a voter a swig, he'll spit out his cud to swallow. Then I'll pull out the twist so he can go right on chawin'." Such stories as these won the support of frontier voters.

In 1827 he ran for Congress and was elected. In 1829, he was re-elected on a Democratic ticket headed by Andrew Jackson for president. In Washington Crockett's broad, frontier humor proved popular. Most of the time he wore fringed buckskin clothing, moccasins, and a coonskin cap. His rough, backwoods stories and his motto, "Be sure you're right, then go ahead." became nationally known.

Crockett did not agree with Jackson's policies on banking and the treatment of Indians, and he was defeated for re-election in 1831. But his vigorous campaign in 1833 again carried him back to office.

Crockett's fight against Jackson's policies made him a favorite of the Whig party. The Whigs saw in him a chance to create an opponent to Jackson with the same appeal as Jackson—son of the frontier and war hero, a man of homespun virtue and rugged honesty. Crockett did not realize he was being used in this fashion, and he went along believing all that the shrewd Whigs told him. He began to fancy himself a profound political thinker and statesman.

In 1834 he dictated his autobiography, 'A Narrative of the Life of David Crockett, of the State of Tennessee'. The book sold well and Crockett dictated another, an account of his trip through the large eastern cities, where the Whigs had warm receptions staged for him. In Philadelphia he was presented with a fine rifle, which he named "Betsy." When Congress adjourned, Davy went home, hoping he might be elected president in 1837. In this he was sadly disappointed The Jackson forces were too strong for him, and he could not even win re-election to Congress in 1835

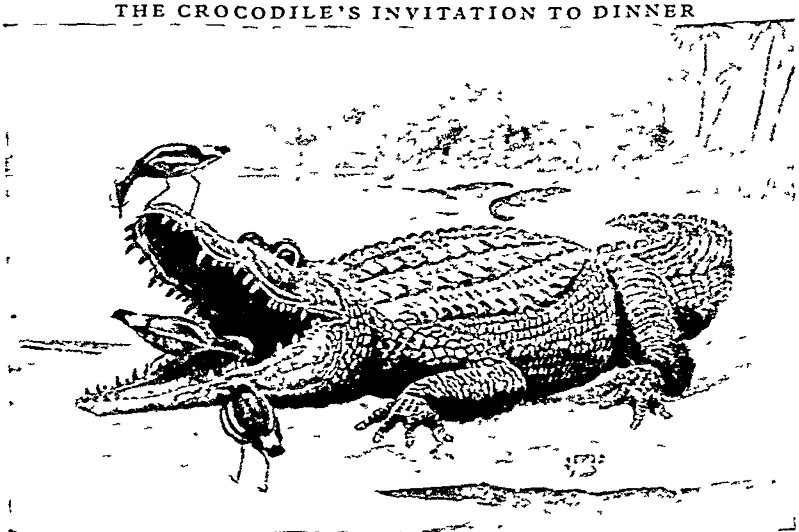
Death at the Alamo

The defeat angered Crockett. He declared that he would "quit the states until honest and independent men again worked to the top of the heap." He left Tennessee and set out for Texas to help in the fight against Mexico.

He arrived at the Alamo fortress in San Antonio some time before the Mexican dictator Santa Anna besieged it on Feb. 23, 1836 (*see* Texas). Crockett and his companions withstood the overwhelming Mexican forces until their ammunition ran out. When the Mexicans swarmed over the fort. Crockett killed more of the enemy with his clubbed rifle butt. But when the battle was over on March 6, Crockett lay dead with the other brave defenders of the Alamo.

CROCODILE. In most warm parts of the world deadly danger lurks in the rivers, lakes, and coastal marshes. Both animals and men must beware of crocodiles. They are huge, flesh-eating reptiles. They feed chiefly on fish, turtles, and water birds. They also seize animals that come to the water's edge to drink. Some species are man-eaters. All are dangerous when they are cornered. On land they can chase their victims with amazing speed and knock them to the ground with a lash of their tails.

THE CROCODILE'S INVITATION TO DINNER



You naturally think that it's the crocodile who is about to dine, but you're wrong. The ziczac or crocodile bird is a guest and not a dish in this case. He picks leeches and other parasites from inside the crocodile's mouth, and the great monster, in return, resists the temptation to close those terrible jaws. Crocodiles have no lips.

.In the heat of the day the crocodiles sun themselves ashore. They look like great gray-green logs, 7 to

30 feet long Close-set, overlapping bony plates cover their backs and necks A tough thick skin covers the sides and underparts This part of the hide makes valuable leather Their heads are long and narrow and the snouts pointed In the Americas, crocodiles may be mistaken for their close relatives the alligators In general, alligators are smaller and their heads and snouts are broader (see Alligator) They live in fresh water The crocodiles prefer salt water

The crocodile's eyes and nose rise above its flat head Thus it can breathe and watch for prey while it stays under water It has no lips and cannot close the mouth tightly A valve closes off the throat in front of the air passage to keep out water Then it breathes through a passage that leads from the nostrils to the back of the throat

The female lays 30 to 60 eggs about the size of large hens' eggs She digs a shallow hole on land near the water's edge and covers the eggs with mud, sand or weeds The warmth of the sun and rotting vegetation hatches them Just before the young hatch, the mother crocodile hears them "coughing" in the eggs She pushes away the mound covering the nest They cut their way out of the tough shells with an "egg tooth" on the end of their snouts The mother leads them to the water, and thereafter they take care of themselves Crocodiles are about eight inches long at birth Some of them live more than 100 years Men hunt them in great numbers for their hides and use the musk glands in making perfume The fat has many commercial uses also

The largest species is the Indian crocodile, or gavial (*Gavialis gangeticus*), 30 feet long This is a timid fish-eater The Nile or African crocodile (*Crocodylus niloticus*) is a man-eater The ancient Egyptians held it sacred and embalmed its body Skin hunters have nearly wiped it out on the lower Nile, but many still live elsewhere in Africa Another man-eater, the salt-water crocodile (*Crocodylus porosus*), lives on the coastal marshes of southern India and Malaysia It often swims far out to sea These two species reach a length of 18 to 20 feet Several species live in Central and South America, the West Indies, and in southern Florida about as far north as Lake Worth The American crocodile (*Crocodylus acutus*), the species found in Florida, reaches 14 feet in length

Crocodiles belong to the order *Crocodilia* (or *Loricata*) The order includes the alligators, caimans, and jacares of America

Crocus When winter snows are melting and the March winds carry a hint of spring, the crocus is one of the first flowers to brighten northern gardens Some bloom in the fall, but the spring-flowering species are the best known They show dainty shades of lilac, yellow, and white

These natives of southern Europe and Asia thrive in almost any climate In addition to the familiar spring crocus, there are many beautiful cultivated hybrids The dried stigmas of one species yield yellow saffron This is used to color and flavor foods, as a dye, and as a medicinal drug

The crocus is a genus of the iris family (*Iridaceae*) There are about 75 species including the spring crocus (*Crocus vernus*) some of the Dutch hybrids of *Crocus moesiacus* and the saffron crocus (*Crocus sativus*) The flowers are showy, solitary long funnel-shaped and erect of six nearly equal segments They have three stamens and the three-celled ovary contains numerous seeds The grasslike leaves spring up from the corm a bulblike fleshy stem protected by scale leaves (see Bulbs Tubers and Rootstocks) Crocus corms should be planted in the fall They should be placed two to three inches apart and three to four inches deep in well worked perfectly drained soil free from clay New corms form on top of the old ones Thus the plants tend to work out of the ground and must be replanted every two or three years The blossoms close in the shade

Croesus (*krē sŭs*), **King of Lydia** We still say "as rich as Croesus" because the great wealth of this king, who reigned 560–546 B C, made him legendary He ruled the fertile land of Lydia in western Asia Minor Gold from the mines and from the sands of the River Pactolus filled the king's coffers to overflowing The Lydians in the time of Croesus, it is believed, were the first of all peoples to coin money Industry and commerce were developed until the power of Lydia extended throughout Asia Minor

The fame of the splendid court of Croesus at Sardis attracted many visitors One of these, legend tells, was Solon, the lawgiver of the Greeks The king proudly displayed his treasures and asked Solon who was the happiest man that he had met He expected Solon to reply, "Thou, O King" But Solon named two or three obscure men who had lived and died happily Croesus was surprised and angry, and said "Man of Athens, dost thou count my happiness as nothing?" "In truth," replied Solon, "I count no man happy until his death, for no man can know what the gods may have in store for him"

There was indeed great misfortune in store for Croesus Cyrus the Great of Persia, extending his vast domains was soon threatening the kingdom of Lydia Croesus consulted the oracle of Delphi in Greece According to the legend, the oracle replied "If Croesus goes to war he will destroy a great empire" So Croesus went out to meet the army of Cyrus and was utterly defeated He had destroyed a great empire, but it was his own

The old story goes on to relate that Cyrus ordered Croesus to be burned alive When Croesus saw the flames creeping upward to consume him, he remembered the words of the wise Solon and cried out, "O Solon! Solon! Solon!" Cyrus was so moved by the story of how Solon had warned the proud king that he ordered Croesus to be released and gave him special protection

Crompton, Samuel (1753–1827) The inventor of the spinning mule was one of three men who revolutionized the English textile industry His improvements of the machines made by Hargreaves and Arkwright transformed spinning from a hand-operated cottage industry to the machine-operated factory process of today Crompton was born in Lancashire, England His father died when the boy was 16 years old, and he went to work as a yarn spinner to support the family He inherited ambition and perse-

verence from his mother, and after his days of toil tramped to Bolton to attend night school.

The yarn produced by Hargreaves' spinning jenny was too coarse and rough for fine grades of cloth, and young Crompton set about the task of overcoming these defects For ten years he earned a scanty living by day, and by night worked at his invention, which he was obliged to guard from his suspicious neighbors. Angry mobs at times threatened to destroy it. With no money to pay the fees for a patent or to secure legal advice, he was cheated out of his rights by manufacturers with whom he made contracts for the use of his invention.

It was 20 years before Crompton had the means to set up a small factory in Bolton, and by that time thousands of his spinning machines were in use, with no profit to himself. He called his machine the "spinning mule," because it was a "hybrid" combining the principles of Hargreaves' "jenny" and Arkwright's "roller frame." It produced a finer, smoother, and more elastic yarn, so Crompton's invention in the end displaced the other. With minor improvements it is used in every textile mill in the world today. Yet all his life this brave genius and world benefactor, who had made wealth for many lesser men, was in needy circumstances. Parliament's tardy grant (in 1812) of $25,000 was lost in unlucky business ventures. He died in 1827 at the age of 74 in very straitened circumstances. (*See also* Arkwright; Hargreaves; Spinning and Weaving.)

The Puritan PROTECTOR *of the* ENGLISH COMMONWEALTH

CROMWELL, OLIVER (1599–1658). The chief leader of the Puritan Revolution in England was Oliver Cromwell, soldier and statesman. Himself a fervent Protestant, he joined with the Puritans to preserve Protestantism and the law against the tyranny of King Charles I. The king was executed in 1649. Cromwell was made Protector of the Commonwealth of England, Scotland, and Ireland in December 1653 and held that office until his death five years later.

Oliver Cromwell, called Ironsides, ruled Britain when it was a republic.

Oliver Cromwell was born at Huntingdon, in eastern England. His father was a well-to-do farmer. When Oliver was 17 he entered nearby Cambridge University, but he had only a short time for study because his father died the next year. Young Cromwell at once returned home to farm the lands he had inherited. He married Elizabeth Bourchier, the daughter of a wealthy London merchant, in 1620.

When he was 29, Cromwell was elected to Parliament. King Charles dismissed this parliament the next year and for 11 years ruled as a despot without calling parliament at all. Finally in 1640 he was forced to call it again. Cromwell was once more a member. He immediately became important to the Puritan cause because of his religious zeal and the vigor with which he defended civil and religious liberties against the king. He was described at this time as "apparelled in a plain cloth suit made by a country tailor, his linen plain and not clean, his hat without a hat-band . . . his voice sharp and untuneable, and his eloquence full of fervour . . .; he was very much hearkened unto."

Cromwell as a General

The people, particularly the Puritans, were gradually aroused to seek the overthrow of the king's unchecked rule. Early in 1642, when civil war was in sight, Cromwell returned to his home and set about raising, equipping, and training a "troop of horse" (cavalry soldiers). His men were full of religious fervor. (Each soldier carried a Bible as an important part of his equipment.) Cromwell would not allow Roman Catholics in his army, but he accepted devout God-fearing believers from all the Protestant churches. For the time in which he lived, this was religious broad-mindedness. This quality was to color his whole career as soldier and statesman.

The quality of Cromwell's troop of horse was first proved at Marston Moor, near York, in July of 1644. Prince Rupert, the most dashing of the royalist leaders, drove the right wing of the Parliamentarians before him, but Cromwell's forces on the left restored the balance and won the battle. Cromwell reported afterward: "We never charged but we routed the enemy. The left wing, which I commanded, being our own horse—saving a few Scots in our rear—beat all the Prince's horse. God made them as stubble to our swords." Little wonder that, after the battle, Prince Rupert gave the name "Ironsides" to Cromwell. This name was soon commonly used for the soldiers that were led by this invincible leader.

As the Civil War dragged on, Cromwell became more and more prominent. He even led a movement for remaking the parliamentary army as a whole, on the model of his own Ironsides. He again won an important and decisive victory over the king's forces at the battle of Naseby in June 1645. King Charles, left almost defenseless, gave himself up early in the following year to the Scots, who had been co-operating with the English to overthrow despotism. Charles, himself a Scot, thought he could come to some agreement with them. The Scots, however, turned Charles over to the English.

England was now ruled by the army and its great leader and by that part of the Parliament of 1640

CROMWELL SAYS 'TAKE AWAY THAT BAUBLE!'

In 1653 Cromwell went to the House of Commons with some of his troopers and turned out the members. Here we see the Lord Protector pointing to the mace and commanding one of his men to remove it. (The mace is the symbol of Parliament s author ty and is always on the table when Parl ament is in sess on.) This Parliament was called the Rump It was the remnant of the Long Parliament which had sat almost con tinuously since 1640 The painting is by Benjamin West.

that was loyal to the Puritan ideals This remnant the s tting members of Parliament was jokingly called the Rump Both the Rump and the army came to feel that Charles was so untrustworthy and autocratic that he must be got rid of Cromwell him self was finally won over to this belief and he became the chief agent in carrying through under the author ity of the Rump Parliament the trial and beheading of the king (1649)

The Rump thereupon proclaimed the whole of the British Isles a republic under the name of the Com monwealth The Scots however now wanted Stuart rule and crowned the young son of Charles I Charles II The Irish who were largely Roman Catholic also resisted Parliament s authority Cromwell now com mander in chief of the army brought the Scots to submission at the battle of Dunbar (1650) and again the next year at Worcester when the Scots were led by Charles II He also crushed the Irish in a cam pa gn that came to a climax in the storming of Drogheda (1649) This is a blot on Cromwell s record for all the sold ers and Catholic priests taken at Drogheda were killed

Cromwell as Protector

Cromwell dismissed the Rump in 1653 when it fell out with the army Not long after he became the head of the Commonwealth under the title of Protector For the next five years he ruled the British Isles Tolerat on was granted to all Protestants Even the Jews who had been legally banned from the country for more than 300 years were allowed in England aga n and permitted to carry on their worship privately Many reforms were begun The navy was made more powerful than ever before and the government gained great respect abroad

Cromwell s rule was not a long one He died peacefully in his bed Sept 3 1658 The office of Protector passed for a few months to his son R chard but Tumble-down D ck' lacked his father s force and genius for leadership

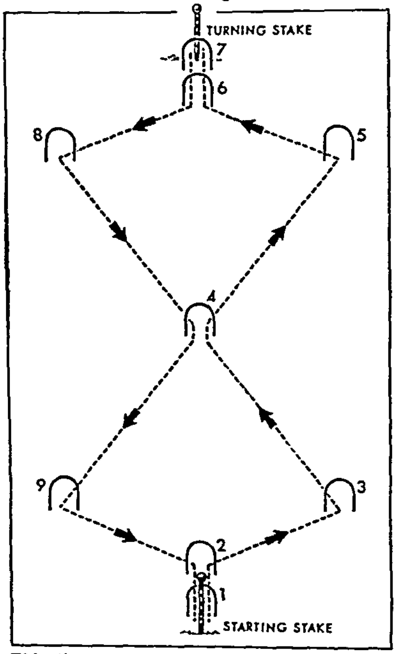
Much that Cromwell fought for was swept away in 1660 when the Stuart rule was resumed by Charles II, yet the Protector s work was not altogether in vain He had caused the defeat of a tyrannical king and he had given a wider measure of toleration than had been known before As the British went on in later centuries to more and more liberal views in both church and state the example of Cromwell and his Protectorate was not forgotten by them

Cromwell was imposing in appearance but not handsome (he had a prominent wart on h s nose) Simple in his bearing at once daring and cautious he was hesitant in council yet decisive in action His state policies were intensely practical and decidedly

liberal for his time. Though deeply religious, he was far from being a gloomy Puritan. He smoked, drank wine and beer, hawked, played bowls, loved horses, and was fond of music. He had an unswerving trust in God. In his last prayer he gave thanks that he had been a lowly "instrument to do God's people some good and God some service." A close associate said of him: "A larger soul, I think, hath seldom dwelt in a house of clay." (*See also* English History; Charles I; Charles II.)

CROQUET AND ROQUE. For a simple but challenging lawn game, people of all ages often choose croquet. The game is simple in principle, but play can be surprisingly skillful and spirited. The equipment consists of nine arches and two stakes, plus a wooden mallet and ball for each player. Lawns of almost any size serve as a court.

PLAN OF A CROQUET COURT



This diagram shows the route of play through the arches of a croquet court. The ideal distance between stakes is 72 feet.

The game begins at the starting stake (which also serves as the home stake). Each player in turn uses his mallet to drive his ball through the arches in proper order. The first player to return his ball to the home stake wins the game. Driving the ball through an arch or striking the turning stake gives a player another stroke at once.

How to Gain Extra Strokes

If one player hits his ball so that it strikes an opponent's ball (*roquet*) he may do one of three things. He may lay his ball a mallet's head length away from the other ball and continue play with two extra strokes. Or he may either *croquet* or *roquet-croquet*. After playing either choice, he can take one extra stroke.

To croquet, the player places his ball against the ball of his opponent. Then holding his ball with his foot or hand he strikes it sharply in order to drive the other ball away. To roquet-croquet, the player also places his ball against the opponent's ball and then strikes his ball without holding it. This drives both balls in the direction the player desires. A rover is one who has driven his ball through all the arches but has not yet touched the home stake. He continues play on his ball to assist his partner and to drive back the opponent's balls.

The History of Croquet

It is not definitely known where croquet was first played. Most historians believe that it originated in France, where it was known as *paille-maille*, and later imported into England as "pall-mall." It was played as early as the 1600's in both countries but in neither place did it have any great popularity.

Croquet was brought to the United States about 1870 and it soon spread all over the nation. The rules for the game generally followed 'Routlege's Handbook of Croquet', published in England in 1861. One group of players, however, wanted a game that required more skillful and scientific play. They made changes in the rules until they had devised a new style of play which they called *roque* (the name was taken from "croquet" by dropping the "c" and "t"). After 1900 the two styles of play became two different games. Croquet retained its popularity as a family game, played for relaxation and social amusement. Roque became a game for specialists, demanding fine skill and strategy. Many cities now have roque clubs which sponsor annual tournaments governed by the American Roque League.

How Roque Is Played

Each of the four corners of a roque court is cut off by an angle line so that the court has eight sides. A wooden or concrete wall about six inches high encloses the playing area. The curbing enables the players to make *carom shots* against the sides as billiard players do. The surface of the court is made of concrete or hard rolled earth. The principle of the game is the same as croquet except that each player uses two balls instead of one. Roque also requires greater accuracy because the arches are narrower. Each mallet has two striking surfaces—one of ivory or hard rubber and one of soft rubber.

CROW. The crow's worst enemy admits that it is clever, probably more so than any other member of the bird family. In the wild state a crow keeps the farmer busy planning "scarecrows" to keep it out of the cornfields. One tame crow can disturb a whole community. It is an American citizen and claims as its domain the temperate region north of Florida to the Arctic coast and west to the arid plains.

With jays, ravens, and magpies, the crow belongs to the family *Corvidae*. It is about 20 inches in length and its glossy plumage justifies the adage "as black as a crow." Its appetite is its weakness. Not satisfied with fruits, seeds, toads, frogs, and small snakes, it robs fields of newly sprouting corn, birds' nests of their eggs, and even eats young chickens.

Crows mate early in spring and build a large stick nest in a tall tree. While the female sits on the spotted blue-green eggs (for picture in color, *see* Egg), the male provides her with food. Young crows eat ravenously and both parents are kept busy satisfying the food demands of their family. Crows do not migrate, but in winter often several thousand will roost at some common center, scattering each morning to their various feeding grounds.

No wild bird taken into captivity has more readily accommodated itself to domestic life or furnished more interesting entertainment for its captors A born thief in his wild state, when tamed he becomes a veritable kleptomaniac He pilfers all sorts of eatable and uneatable objects, bright trinkets proving irresistible to him Pet crows are great imitators, and some may be taught to "talk"—to utter several words and seem to use them intelligently Once they are accustomed to a household, crows need not be caged

The fish-crow is smaller than the common crow and feeds largely on such water creatures as die and float ashore He is a great egg-eater and is a constant menace in the heron and ibis rookeries The Florida and western crows are smaller forms of the common crow Scientific name, *Corvus brachyrhynchos*

When CHRISTIAN *Fought* INFIDEL *for* PALESTINE

SPLENDID heroism religious self sacrifice and Christian devotion—these light up with an ever memorable refulgence those vivid dramas of the Age of Faith which we name the Crusades In one aspect they are merely a new phase of the age-long conflict of East and West—of Europe and Asia, in another they anticipate the outburst of colonizing and commercial expansion which characterizes the modern world At the beginning of the Crusades, Christian Constantinople and Mohammedan Baghdad as much excelled Western Europe in orderly civilization as Europe did barbaric America in the days of Columbus, and every journey had its lessons of wonder From whatever standpoint we view them the Crusades are the central point of the Middle Ages, ending the period of the Dark Ages, and leading on to the flowering of Western Europe in the Renaissance of Art and Learning

CRUSADES When the fierce Seljukian Turks captured Jerusalem from the tolerant Saracens, in 1071, they began a cruel persecution of the Christians who were among the inhabitants of the land Pilgrims on their way to the Holy City were attacked, robbed, and beaten The sacred places of the church were profaned or destroyed To the Christians of Europe, Jerusalem was a holy spot The tomb of Christ the Mount of Olives, Golgotha and all places and things associated with the life and death of Christ were so sacred that they were believed to possess divine powers of healing and forgiveness So when news of the capture of Jersualem came to Europe, great excitement and indignation were felt

The Most Important Speech Ever Made

The eastern Emperor Alexius, whose predecessor had been defeated and slain by the Seljukians feared for the safety of Constantinople itself, and sent an appeal for assistance to Pope Urban II at Rome A council was called at Clermont in France, in 1095, and there the pope made an eloquent speech, urging his hearers to undertake a crusade to rescue the Holy Land. No speech in history has ever had greater results Fired with religious zeal, clergy, knights, and people cried, God wills it!' and pressed forward to offer their swords to the cause On their breasts as they went and on their backs as they returned they wore a cross (in *Latin crux*) of blood red cloth, *from which* comes their name, "crusaders '

Preparations were immediately begun for the long difficult journey to Jerusalem, which we call the First Crusade (1096–99) Many of the common people were so deeply stirred that they were unwilling to wait until the time set by the council for the beginning of the crusade At least four separate bands started for the East in the spring of 1096 A knight named Walter the Penniless successfully led a large number of crusaders to Constantinople Another company under the leadership of a monk named Peter the Hermit was not so fortunate Wholly unprepared for a journey of over two thousand miles, the history of their struggle to the East is one of hardship, starvation, and death More than half perished or were taken as slaves as they passed through Bulgaria and few of the many thousands who started under such leadership lived to see the Holy Sepulcher

In August 1096 the first real armies of knights and princes began their march toward Palestine They were in four main companies, under such famous leaders as Godfrey of Bouillon Robert of Normandy, Raymond of Toulouse, and Bohemond the Norman, son of Robert Guiscard of Sicily After varying fortunes the crusaders reached Constantinople, and after some delay, moved on toward Jerusalem After a trying and dangerous march across Asia Minor, the crusaders came at last within sight of the city of Antioch with its hundreds of towers For seven months the siege of the city dragged on, besiegers suffered almost as much as the besieged At last the city was captured. But the sufferings of the crusaders did not end The besiegers were no sooner in the city than they were themselves besieged by a Turkish army under the Seljukian sultan After three weeks the crusaders were in a pitiable condition Disease and famine thinned their ranks and despair led to loss of courage and discipline The outlook seemed hopeless

Inspired by a Dream Story

The situation was saved in a strange manner A priest among them Peter Barthelemy, announced to the leaders of the army that he had seen in a dream, thrice repeated, the head of the lance which had pierced the side of the Savior It was hidden under the high altar of the church, and if found would bring victory to the Christians Although many were skeptical search was made and Peter himself found the spear So great was the enthusiasm aroused by this discovery—whether real or feigned—that the crusaders attacked the Turks with fanatical valor and utterly routed them

The crusaders stayed in Antioch six months Many

of them had been killed, some had perished from hardships in the long marches, thousands died from the plague. When in June they set out for Jerusalem, only a few thousand of the original hundreds of thousands remained alive. But the hardships and despair of the long march were forgotten when they crossed the last hill, and saw the Holy City before them. Stretching out their arms, they fell on their knees and kissed the ground, while a shout went up on all sides, "Jerusalem, Jerusalem!"

After several weeks of fighting the city was taken. There followed in the streets where the gentle Christ had walked a massacre such as the Turk had not been guilty of in his fiercest moments. Blood flowed in streams, and the bodies of the dead lay thick along the public ways After the slaughter, the crusaders walked barefooted and bareheaded, and knelt at the Holy Sepulcher.

Most of the crusaders soon returned to their homes. Those who remained in the Holy Land were presently joined by new companies of crusaders who were constantly arriving from Europe. Godfrey was chosen ruler, with the title Defender of the Holy Sepulcher. Legend says he refused the crown and title of king, saying "he would never wear a crown of gold where his Savior had worn a crown of thorns." Castles were built and special orders of knighthood were formed to protect the Holy Land. Chief among these were the Knights Hospitalers, the Knights Templars, and the Teutonic Order (*see* Crusading Orders).

The Second Crusade (1147–49) came 50 years after the first and was one of the greatest failures of history. It was preached by the famous French monk, St. Bernard of Clairvaux. He refused the leadership of the expedition, and under Conrad III of Germany and Louis VII of France it was so mismanaged that it accomplished nothing.

RICHARD THE LION-HEARTED ASSAULTS JOPPA

England's famous crusader leads his knights to the attack in the battle which gave the Mohammedan stronghold to the Christian forces.

After another 40 years (1187) Jerusalem was taken from the Christians by Saladin, one of the greatest rulers the Mohammedans ever had (*see* Saladin). He was wise in counsel, brave in battle, and as chivalrous in conduct and sincere in his faith as the best of his Christian foes. When Saladin captured the Holy City there was no massacre of captives, as there had been when the crusaders had defeated the Turks. Instead, the greater number of the defeated were allowed to go free on paying a ransom.

Saladin's conquest gave rise to the Third Crusade (1189–91). This was led by the aged emperor of Germany, Frederick Barbarossa (so called from his red beard), Philip Augustus of France, and Richard the Lion-Hearted of England. Frederick, although he was 70 years old, led his army with ability and all went well with the Germans until the old Emperor was drowned in a mountain stream in Asia Minor. The German expedition then fell apart. In later centuries many of the German people refused to believe the Emperor was dead. They told stories of a lonely cave far up on the mountain side where he slept the long years through, his head resting on his hand, the long red beard growing out among the rocks.

Richard of England and Philip of France, instead of taking the old land route down the Danube valley, went from France in ships by way of the Mediterranean. When they reached the Holy Land they found the Christians besieging Acre. After a weary siege of 23 months, the city was taken; but Philip and Richard quarreled, and Philip soon returned to France. Richard remained in Palestine to wage a hopeless war. Some time later he too left the Holy Land, and after exciting adventures finally reached England. But before leaving Palestine Richard made a treaty with Saladin which permitted Christian pilgrims to visit the Holy Sepulcher without being molested.

ST BERNARD ROUSES WESTERN EUROPE TO CRUSADING ZEAL

When word came from Palestine that Jerusalem captured for the Chr st ans by the First Crusade was again in danger the forces of Christendom sprang to arms The pope commiss oned St Bernard of Clairvaux to preach a Crusade and Bernard s eloquence secured large forces for the effort This Second Crusade however lacked good m litary leaders and failed completely

The aim of the Fourth Crusade (1202–04) was to attack the Mohammedans in Egypt. This required transportation across the Mediterranean, and the crusaders bargained with the Venetians for shipping facilities. The Venetians then proposed that the crusaders first assist them in capturing a rival commercial city, Zara, across the Adriatic Sea. This was a Christian city but, oddly enough for knights of the cross, the crusaders agreed. The Venetians then suggested a still more remarkable adventure—the seizure of the great Christian city of Constantinople, which had recently been favoring Genoa at the expense of Venice. Constantinople was taken and pillaged; and the conquerors divided not only the spoils of the city but also the lands of the emperor. In place of the Greek or Byzantine Empire (*see* Byzantine Empire), a "Latin Empire" was set up, which lasted about half a century. In this crusade, commercial and political ambition overshadowed religious zeal.

If we should read about the Children's Crusade (1212) in a fiction story, it would seem absurdly impossible. Bands of French and German children gathered and moved southward, expecting miraculous aid in reaching and conquering the Holy Land. Some returned, some were sold into slavery, and some died of hunger and exposure.

On the Fifth Crusade (1228–29) Frederick II of Sicily, emperor of Germany, secured Jerusalem by negotiating with the Mohammedans, who were now weakened by divisions. In 1244, however, a new horde of Turks made themselves masters of Jerusalem. A Sixth Crusade (1249) followed, led by Louis IX of France against Egypt, now held to be the key to Palestine. The saintly King Louis was taken prisoner, and was obliged to pay a heavy ransom. The Seventh Crusade (1270) was again led by St. Louis of France, and by Prince Edward, afterward Edward I of England. The French king died of the plague, and nothing was accomplished by this adventure. Acre, Antioch, and Tripoli were held by the Templars and other crusading knights for some time; but Acre, followed by the others, surrendered in 1291. By the end of the 13th century the Christians, as crusaders and conquerors, were ousted entirely from the Holy Land; but Christians, as traders, remained throughout the eastern Mediterranean.

Lasting Results of the Crusades

Crusaders thought of themselves, no doubt, as soldiers of the cross; but there were other influences at work. Some historians, indeed, regard the Crusades as an early phase of that vastly important movement known as the expansion of Europe.

Up to the time of the Crusades, Christendom had been on the defensive against invaders, and had been busy building an agricultural system centering around the manor and the feudal lord. There was very little town life except in Italy, and trade was mainly local. However, there was a growing need for expansion of territory and of trade to keep pace with the needs of the increasing population. Knights without land and younger sons having no fiefs because of the law of primogeniture—the right of the eldest son to inheritance—looked eastward in the hope of carving out estates. Also the authorities saw in the Crusades a method of getting rid of the floating population of beggars, vagabonds, and criminals. The townsmen, who were rapidly becoming more numerous and more influential, were stimulated to develop commerce with the East. New foods and textiles began to make an appearance in the markets and fairs of western Europe. Among these were cane sugar, buckwheat, rice, the apricot, the watermelon, the orange, the lemon, the lime, cotton, damask, satin, velvet, and various dyestuffs. The use of spices from the Orient greatly increased. New tastes developed.

The Christians saw large cities, magnificent buildings, highly developed arts and crafts, medical skill, scientific knowledge—in a word, they found in Mohammedan lands of the Near East a civilization in many ways superior to their own. And there also, to stimulate further ambition, they heard reports, true or extravagant, of even greater opportunities for wealth and adventure in the Far East.

The Crusades failed in their primary aim to regain the Holy Land; but they resulted in an intellectual awakening which brought on the Renaissance, and in an expansionist movement eastward, which, blocked by Asiatics, presently turned westward, led to the discovery of America, and culminated in the Europeanizing of the world.

CRUSADING ORDERS. The first of the three great military and religious orders that arose from the Crusades were the Knights of St. John, more commonly known as Hospitalers. Formed between the First and Second Crusades, they grew out of an earlier organization for taking care of sick and wounded pilgrims and crusaders. The Knights Templars took their name from the location of their headquarters in the so-called Temple of Solomon in Jerusalem. Somewhat later in origin and similar in purpose were the Teutonic Knights, who were mainly Germans.

The members of these orders conformed to both military and religious discipline. They were soldiers with the obligations and training of knighthood; and they took the usual monastic vows. They were described as "lions in war, lambs in the house, to the enemies of Christ implacable, but to Christians kind and gracious." They established castles and garrisons as well as hospitals in the region of Palestine, and formed branches in the home countries. In course of time, kings and others conferred upon the orders power and possessions in many lands, until they became important factors in the history of Europe. Their leaders were summoned to the great church councils; their houses were used as strongholds for the royal treasure; and kings, when pressed for money, depended on them for loans.

The wealth of the Templars appears to have been one reason why Philip IV of France resolved to secure from the pope in 1312 an order for disbanding them and for taking over their wealth. The Hospitalers, during the later Crusades, established themselves in

the island of Rhodes In the 16th century the Emperor Charles V gave them the island of Malta and they came to be known as Knights of Malta The Teutonic Knights in the 14th and 15th centuries renewed their crusading activities by warring against the heathen Slavs near the Baltic Sea Their religious zeal was not unmixed with colonizing and trading enterprise and thus they had much to do with the founding of Prussia At the time of the Protestant Reformation [illegible] the Teutonic Order was practically dissolved

ROBINSON CRUSOE *in* FACT *and* FICTION

He caught the goats and brought them to us on his back Swift as the wind Selkirk outran the dog that tried to help him

CRUSOE, ROBINSON

We all know the story of Robinson Crusoe the hero of Daniel Defoe s famous novel—how he was shipwrecked on an uninhabited island where he had many adventures particularly with visiting cannibals how he rescued one of their victims who became his Man Friday and finally how he was taken off the island by a passing vessel

Perhaps you know also that the story of Robinson Crusoe is based upon the true adventures of a British sailor named Alexander Selkirk who lived from 1676 to 1721 The story island of Crusoe s adventures was placed at the mouth of the Orinoco River in sight of Trinidad The real island of Selkirk s adventures is

in the Juan Fernandez group, 400 miles off the coast of Chile, to which it now belongs as a national park.

The "Real Robinson Crusoe"

Selkirk was born in Fifeshire, Scotland. He became a sailor at an early age and took part in privateering expeditions to the South Seas, as the Pacific was then called. In 1704, when he was 28, he embarked as sailing master, or mate, of the English vessel *Cinque Ports*. In the course of this voyage he quarreled with the captain of the vessel, and was left, at his own request, on the uninhabited island which is now called Mas-a-Tierra. The leaky condition of the ship, as well as his quarrel with the captain, was the reason for Selkirk's strange request. Before the ship left, Selkirk repented of his rash intent and begged to be taken on board again, but this was refused. After four years and four months of solitude on the island he was discovered and rescued by the British ship *Duke* in January 1709.

In these four years Selkirk had seen several ships pass by his island. Two had anchored for wood and water, but on discovering that they were Spanish, he had climbed a tall tree rather than fall into their hands. England and Spain were at war, and he feared that he might be killed or sent to work as a prisoner in the mines of South America. When the British vessel *Duke* came to anchor and sent a party ashore for water, they found "a man clothed in goats' skins, who looked wilder than the first owners of them."

The commander of the rescuing vessel, Captain Woodes Rogers, gave an account of Selkirk's adventures in a book entitled 'A Cruising Voyage Round the World,' which he published a few years later.

"He had with him," says Captain Rogers in telling how Selkirk was left on his island, "his clothes and bedding, with a firelock, some powder, bullets, and tobacco, a hatchet, a knife, a kettle, a Bible, some practical pieces (useful articles), and his mathematical instruments and books." It was lucky for him that he had his books, for they helped him to fight against lonesomeness and despair. With his tools he built two huts of pimento trees, lining them with the skins of wild goats.

After a short time his powder, of which he had only a pound, gave out. For a time he could kill no more game and could make a fire only by rubbing together two dry sticks. He slept only when he could watch no longer, and "never ate until hunger constrained him." He had no salt to season his fish, which were easy enough to catch, and so lived on crayfish, which better pleased his taste. Gradually Selkirk found ways of overcoming his difficulties. He captured great turtles on the beach, and he learned to take the goats by running them down.

How Selkirk Outran Goats

"He ran with wonderful swiftness through the woods," said Captain Rogers, "and up the rocks and hills as we perceived when we employed him to catch goats for us. We had a bulldog, which we sent with several of our nimblest runners, to help him in catching goats; but he distanced and tired both the dog and the men, caught the goats and brought them to us on his back." Selkirk's lack of salt was forgotten in the use of the fruit of the pimento tree, and of a black pepper called malageta. Nor did he lack vegetable food. "He had enough of good cabbage from the cabbage tree," writes the captain.

His clothes wore out very soon. He found that he could get along without shoes, and that goats' skins served for the making of a coat and cap. "Having some linen cloth by him, he sewed himself some shirts with a nail, and stitched them with the worsted of his old stockings, which he pulled out on purpose." Fortunately, Juan Fernandez Island never has very severe weather. There is a little frost and hail in June and July, when it is winter in the Southern Hemisphere, and in summer the heat is never unbearable.

Defoe describes Robinson Crusoe as amusing himself by taming parrots and kids. Alexander Selkirk found his island infested with rats. By feeding and taming the stray cats whose ancestors had been left on the island by visiting ships, he succeeded in keeping down the number of the rats. Captain Rogers tells us that "he likewise tamed some kids, and to divert himself would, now and then, sing and dance with them and his cats." In the adventures of the real Robinson Crusoe there is nothing which corresponds to the visits of the cannibals to the island and the escape and companionship of "Friday."

It is not at all surprising that Alexander Selkirk's strange life should have left its mark on him. He had kept his body healthy and his mind sane by working hard, by running through the woods and up the heights, and by making companions of the animals on his island. But he could scarcely make himself understood by the crew of the ship that rescued him, and he had lost all taste for English food.

Alexander Selkirk returned to England in 1711, after serving in command of one of the vessels taken by Captain Rogers as a prize, but again embarked and followed the sea until his death in 1721. In 1868 the officers and crew of the British naval vessel *Topaz* erected a monument to Selkirk at a spot called "Selkirk's Lookout" on Juan Fernandez Island.

The Robinson Crusoe of Fiction

Two accounts of his adventures were published soon after his landing, one the story by Captain Rogers and another by Edward Cooke. Selkirk also wrote an account of his own, and Sir Richard Steele sketched his story in a magazine. Defoe had access to all this material, and he also met Selkirk and heard of his adventures from his own lips. But 'The Life and Strange Surprising Adventures of Robinson Crusoe', published in 1719, is not the authentic autobiography it purports to be. Defoe had a great gift for inventing details and making them seem like authentic history. He owed to Selkirk only the theme for his story—a civilized man, alone on a desert island, successfully pitting his courage and skill against nature. Because this theme has such universal appeal, 'Robinson Crusoe' ranks as one of the world's most popular classics (*see* Defoe).

CRYSTALS Just as a violet seed contains the germ of a beautiful flower waiting for soil and moisture and sunlight to develop it, so most of the world's so-called 'dead' substances contain in themselves the possibilities of strange "flowers" we call crystals, which take form as soon as they are given a proper chance *If you watch a window pane on a very cold winter* day you will see the 'flowers" of water growing upon it in the delicate and shapely designs of frost crystals Soot certainly has no form or beauty, yet its crystal is the most brilliant of all gems—the hard and glittering diamond

The commonest crystals are those of sugar and salt If you dissolve these substances in water the crystals disappear, but as soon as you let the water evaporate, they are formed again Among other well-known substances which take on crystalline forms are sulphur, camphor, mica, quartz, nearly all the precious stones, the metals, and, in fact, most solid minerals in their natural state (*See* Minerals)

The most important law of crystals is that each substance has its own particular crystal forms different from those of any other substance Yet all the countless forms may be divided into six or seven groups, based upon certain geometrical designs common to each group

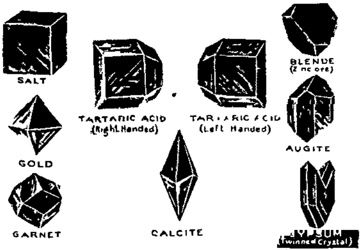
Chemical elements or compounds which are not in crystal form are said to be "amorphous" from Greek words meaning "without shape" Carbon, for instance, may exist in the amorphous form of lampblack or in either of two crystalline forms—diamond or graphite

But there is much more than a mere *difference of shape* between the crystalline and amorphous forms of a substance, or between two crystal forms of the same substance Each crystal possesses internal peculiarities which persist even when the shape of the crystal is imperfectly formed, as is usually the case in nature Thus a crystal will expand more in one direction than in another under the influence of heat, and it has running through it 'lines of cleavage" along which it will split most readily, as anyone knows who has tried to chip a piece of ice from a large block Crystals also refract light differently according to the direction in which it passes through them (*see* Light), and certain crystals of sugars and other organic substances differ in producing right and left rotation of polarized light (*see* Sugar) The power to conduct electricity varies also in different directions, a feature useful in radio work (*see* Radio) A strange example of the electrical influence of crystal forms is the fact that the diamond is a non-conductor while its carbon-brother, graphite, is an excellent conductor

Crystallography, as the study of crystals is called, is carried on today principally by the X-ray spectrum method developed by Laue, the Braggs, and others after 1912 These men find that the cleavage planes in crystals will defract X-rays, producing patterns *resembling spectra* *From these patterns we learn* the shape of the molecule and also that crystal like structures exist even in cotton and silk, contributing to its character These methods are among the most powerful used by modern science to discover the nature of atoms (*see* Chemistry X Rays)

Crystals are usually formed by dissolving a substance in hot water, and letting the solution cool Cool water will not hold as much dissolved substance as hot, so the surplus "crystallizes out" Mixtures may often be separated because different substances crystallize at different stages of the process

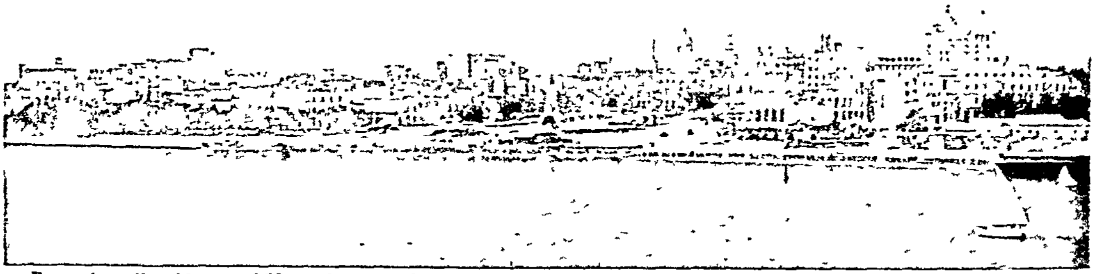
SOME BEAUTIFUL CHEMICAL "FLOWERS"



Did you know that the tiny grains of salt you shake on your food are little cubes, and that some of the gold which miners and prospectors find consists of tiny 8 sided figures like the one you see here? But there are even stranger things about crystals Some of them are 'twins' and some are 'right handed' and some are 'left handed" *Those two crystals* of tartaric acid, for instance seem exactly alike at first but a close look will show you that one is the 'reverse" of the other, each one being just like the image of the other in a mirror And the curious thing is that 'right handed' tartaric acid is exactly the same in chemical composition as 'left handed' except *for some peculiar internal arrangement which is* responsible for the 'reverse' crystals and which makes the two kinds behave differently in many other ways

The heat treatment and alloying of metals is largely carried on to alter their internal crystal structure and so obtain different degrees of hardness, strength, and so on (*see* Alloys) The so-called "crystallization" which turns metals brittle under repeated stresses, like the bending back and forth of a wire, consists usually of a rearrangement of existing crystals and a loosening of their lines of cleavage

CUBA—*the Queen of the* ANTILLES



From above the old guns of Morro Castle, which guards the channel leading to the harbor, we are looking across to Havana, the capital. Modern office buildings and hotels have transformed the skyline, which formerly had few tall structures.

CUBA. "The peace of Cuba is necessary to the peace of the United States; the health of Cuba is necessary to the health of the United States; the independence of Cuba is necessary to the safety of the United States." So said President McKinley in 1901, just before Cuba was made an independent nation with the help of the United States. Cuba has since developed from a backward Spanish colony, ridden with disease and bad government, into a respected and progressive member of the American family of nations, closely bound to the United States by trade and friendship.

This long narrow island, "curved like a bird's tongue," lies squarely across the entrance to the Gulf of Mexico. Hence it commands the northwest approach to the Panama Canal, and is vital to United States defense (*see* Navy). It is only 92 nautical miles from Key West, Fla.

With an area of 41,634 square miles—about the size of Virginia—it is the largest of the West Indies. It is 730 miles long and varies in width from 22 to 160 miles. Bordering it are some 1,300 tiny islands. These, with the larger Isle of Pines (about 1,180 square miles) off the southwest coast, bring the total area to 44,164 square miles.

The "Queen of the Antilles" is part of the sunken mountain chain that makes up the West Indies. In the west a low range borders much of the narrow northern coastal plain. In the center are low scattered mountains. In the east the rugged Sierra Maestra range reaches 7,780 feet at Turquino Peak. The southern coast is low and sandy, and in the west, marshy. But most of the island is a rolling plain, like Iowa. Numerous short swift rivers race north or south to the sea. Some "disappear," dropping into caves and then tunnels. Only the westerly flowing Cauto is navigable for any distance. Light craft can ascend it for 70 or 80 miles.

Advantages of Climate and Soil

Cuba's greatest gifts are its climate and its rich soil. From them spring its most important industries—its agriculture and its vast winter tourist business. It lies just inside the tropics, in the path of the trade winds, which cool the summer heat to an average temperature of 80° F. In winter, the surrounding seas bring warmth, giving an average winter temperature of about 70° F. Frosts are unknown. Hurricanes, sometimes very destructive, may come in August, September, and October. Rainfall is abundant, with an average of about 55 inches, three-fourths of it in the "wet" summer season from May through October.

The soil is the most fertile in the Caribbean. Two-thirds of it is rich limestone soil. Plant life is luxuriant. More than 30 types of palm are found. The royal palm furnishes timber for the peasant's hut and thatch for his roof. Ruthless logging and land clearing have so reduced the forests that they now cover only about a tenth of the land. But there are still stands of mahogany, red and black ebony, rosewood, pine, and the towering *ceiba* (silk-cotton tree) They supply charcoal, the chief fuel.

Most of the nearly 300 species of birds are familiar also in the United States. There are no large animals and few snakes, none poisonous. Crocodiles and lizards provide skins for leather goods.

Despite attempts to diversify crops, economic life revolves around sugar cane. About half the island is in farms, and more than half the cultivated area is planted to cane. Cuba exports more sugar than any other country. The year-around frost-free grow-

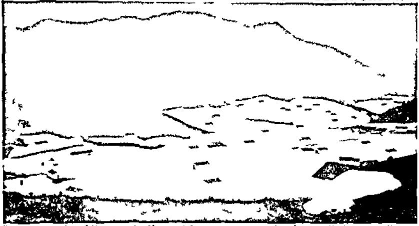
ANOTHER LOAD FROM THE SUGAR BOWL OF THE WORLD

Oxcarts with huge wheels and six or eight oxen are needed to haul the great loads of sugar cane over the rough and often muddy roads.

ing season and the rich soil make from four to s x crops possible from one plant ng

Sugar has been both a blessing and a curse It has attracte l more than a b ll on dollars from investors in the Un ted States But sugar companies own more than a th rd of the land and control the operat on of nearly one-half And sugar has tremendous ups and downs Prices have ranged from 21 cents a pound to about 2 and exports from 5 million tons a year to 2 mill on

WHERE SOME OF THE WORLD S COSTLIEST TOBACCO IS GROWN



The finest grades of the a omat c Havana tobacco a e grown under cheesec oth to p otect it f om sun and wind on the sandy limes one so l of hi y wes e n Cuba The reg on that p oduces this famous c op is only about 90 miles by 10

Tobacco is another valuable crop The best Havana cigar wrappers are made from the tobacco grown on the small Vuelto Abajao (lower turn) district in the west Upland farmers raise cacao and coffee The east has banana plantations and in the east-central districts are large cattle ranches Vegetables and fruits are ra sed for winter export to the United States

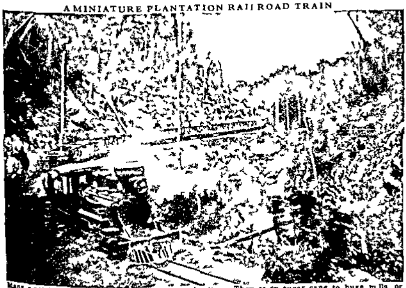
Other Factors in Cuba s Prosperity

Iron is the most important mineral The extensive iron deposits are largely owned by United States cor porat ons Copper manganese chromium aspl alt nickel and some gold are also mined

Manufactures other than sugar refining include cigars c garettes meat products vegetable oils tex t les furniture and clothing From a quarter to a half of the sugar is usually exported to the United St ites Fruits and vegetables are the other chief ex ports The United States usually takes three-fourths or more of the exports and supplies two-thirds of the im p rts of food textiles and machinery

(ood transportation has helped in Cuba s growth Tl ere are so many good harbors that Cuba has been calle l Tl e Isle of a Hundred Harbors More than 3 000 miles of commercial railway link the principal cities and sugar plantations operate another 5 000 miles A sea train or railroad ferry service carries fre ght cars to several United States ports Good high vays network the island The Central Highway is an engineering triumph running the length of Cuba with few curves and bridging countless streams and ravines Airplane service is well developed

A MINIATURE PLANTATION RAILROAD TRAIN

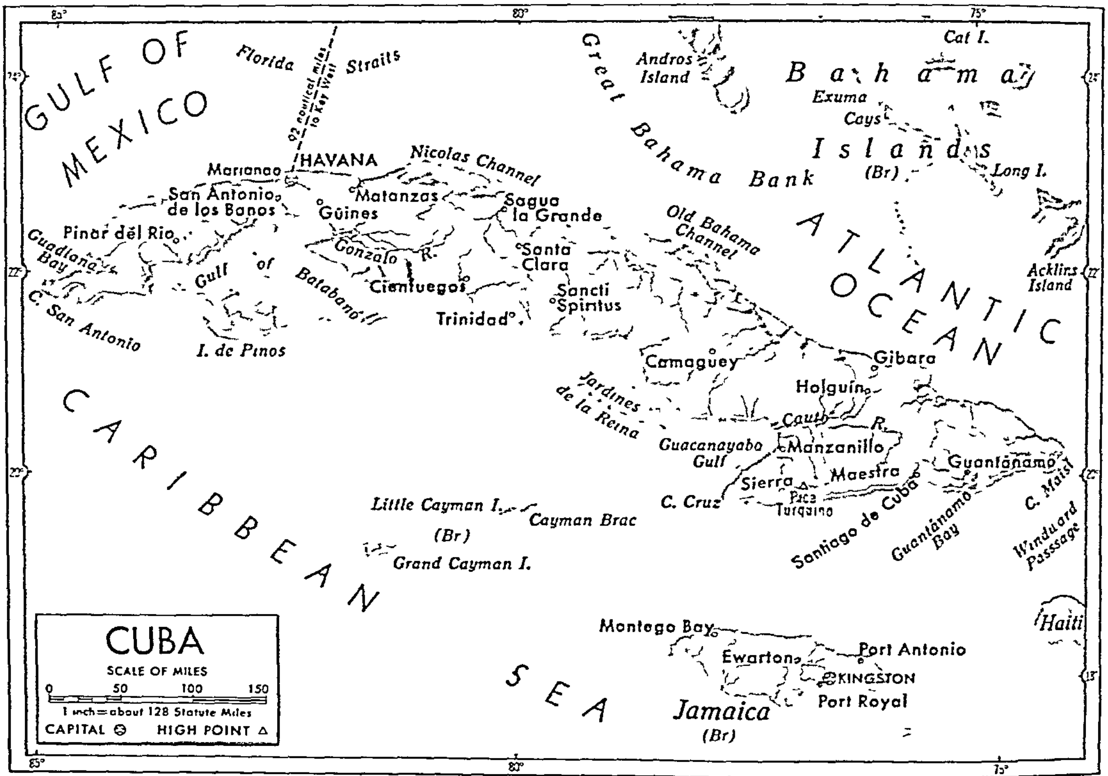


Many p antations own na ow gauge ra ways ke this They ca ry sugar cane to huge m lls or centrals where t is crushed and the syrup is bo ed nto sugar

Havana is the capital and largest c ty (*see* Havana) Near by is Ma rianao second largest c ty *Santiago in the* hilly southeast was the capital until 1826 Here or near by the most decisive battles of the Spanish American War were fought Cam aguey in central Cuba perhaps best keeps the romantic flavor of Old Spain

The People

In race and customs Cuba is predominantly



Cuba is a land of rolling plains and scattered mountain ranges from which short rivers fall swiftly to the sea. The irregular coast line affords many good harbors. Guantánamo Bay, at the eastern tip, is leased to the United States as a naval base. It controls the entrance from the Atlantic Ocean to the Caribbean Sea through the Windward Passage.

Spanish. Two thirds of the people are white; the others, native or mixed. The typical white Cuban is slender, with small hands and feet. He is charmingly polite and he loves color, music, and dancing. The fast-moving Cuban dance called the *rumba*, and Cuban music, with its characteristic guitar and pebble-filled gourd, became highly popular in the United States.

Education is free and compulsory. The University of Havana was founded in 1721. In literature, Cuba has some notable figures (*see* Latin American Literature). In science, Dr. Carlos Finlay in 1881 suggested that mosquitoes carry yellow fever (*see* Mosquito).

Landmarks in Cuban History

Cuba was discovered by Columbus in 1492. He called it the "most beautiful land human eyes have ever seen." Spain began its conquest in 1511, subduing the Arawak and Carib Indians. Sugar cane was introduced in the first quarter of the 16th century, and soon African slaves were brought in.

Frequent insurrections failed to end Spain's harsh rule and exploitation. The United States watched sympathetically, and in 1847 President Polk offered to buy the island, but Spain refused. In 1868–78 came the savage outbreak known as the Ten Years' War. "Cuba Libre" (Free Cuba) became the rallying cry for another revolt in 1895. The cruelties of the Spaniards led to protests by the United States. Then on Feb. 15, 1898, the U.S.S. *Maine* blew up in the harbor of Havana. Public opinion blamed Spain, and the United States declared war April 24, 1898 (*see* Spanish-American War). The peace treaty forced Spain to surrender claim to Cuba and provided for its temporary military occupation by the United States. During the three years that the island was under American military rule, much was done to help prepare the people for self-government. In 1902 the Republic of Cuba was established. The United States formally renounced its right to intervene in Cuban affairs in 1934.

Fulgencio Batista of the army led a "sergeant's revolt" in 1933 and took over the government. He became president in 1940 and obtained the adoption of a new constitution. It provided for a semiparliamentary government, social insurance, a maximum work week, compulsory voting for men and women.

In the second World War, Cuba worked closely with the United States. On March 10, 1952, General Batista, who had been out of power since 1944, overthrew the government a second time. Suspending the constitution, he made himself chief of state with dictatorial power. He promised that a free national election would be held in 1953. However, on Feb. 27, 1953, he postponed the election until June 1954. He said that the constitution would be restored in September 1954. (*See also* West Indies.) Population (1953 census), 5,853,898.

CUCK'OO. Many people know the cuckoo only as a clock from which a bird cries the hours, "Cuckoo, cuckoo, cuckoo" The clock bird imitates the call of the European cuckoo Since the call is easily reproduced by musical instruments, the European cuckoo has also found a place in music, notably in Beethoven's 'Pastoral Symphony' There is no similarity to the mournful call of the American birds, a low-pitched *cl uk-cl uck, cl uk-cl uck, cow, cow cow*

The yellow billed and black billed cuckoos of North America are long, slim, dovelike birds with a secretive way of slipping silently through the thickest foliage of the trees They are brownish gray with white breasts The yellow billed cuckoo may be distinguished from the black billed by its rufous wings, white-tipped tail, and yellow lower bill Cuckoos nest from southern Canada to Mexico and from coast to coast They winter in South America These birds are often called rain crows They feed on destructive insects being particularly fond of tent caterpillars

CUCKOO S FEEDING TIME

This mother bird has her favorite food a tent caterpillar

The European cuckoo is bluish gray, with long tail and pointed wings The female, like the American cowbird builds no nest but places her eggs in the nests of other birds and leaves the young to be reared by the foster parents

Related to the cuckoos are the anis The groove-billed ani is found in southern Texas, the smooth-billed ani in Florida and the West Indies Both species range southward to South America Anis are dull black birds with long rounded tails and short wings The peculiar bills are compressed vertically and are almost as high as they are long The birds follow cattle and feed on the insects they stir up from the ground and also on the parasites which infest their bodies The cattle seem to have no objection to the birds perched on their backs

They have strange nesting habits They build only one nest in which two to a dozen females lay their eggs Males and females share in the task of incubating the eggs and rearing the young

Cuckoos, anis, and road runners belong to the order *Cuculiformes* The scientific name of the European cuckoo is *Cuculus canorus* yellow billed cuckoo, *Coccyzus americanus* black-billed cuckoo, *Coccyzus erythropthalmus*, smooth-billed ani, *Crotophaga ani*, groove billed ani, *Crotophaga sulcirostris* (*See also* Road Runner)

CUCUMBER Used unripe for pickling and for salads the cucumber is one of our favorite vegetables Boiled cucumbers are a staple article of diet in the Far East and in Jamaica For at least 3,000 years the vegetable has been cultivated in northern India, where it probably originated It is now grown in all civilized countries as a field and garden crop Raising cucumbers in hothouses the year round has come to be an important industry

The fruit is borne on a trailing prickly vine which shows clearly its relationship to the melons pumpkins squashes, and gourds When the fruits are small the skin is spiny, but as they mature it becomes smooth The skin is still green when they are gathered for use as salads or pickles, and the flesh, which is white and somewhat watery, contains many soft flattened seeds As they ripen, the skin becomes yellow the flesh tough, and the seeds large and hard Some varieties are very small, only two to four inches long when they mature, while a "serpent" cucumber grown usually as a curiosity, twists its slender body in and out among the foliage for nearly a yard The white spine is probably the most popular group of varieties for garden and hothouse cultivation in the United States

A variety growing steadily in favor is the lemon cucumber so named because it is about the size and color of a lemon It will grow in almost every part of the United States The gherkin cucumber is a native of Jamaica and is grown in the West Indies for pickling The gherkins of mixed pickles, however, are young cucumbers

Cucumber vines grow quite long, so it is necessary to plant the hills several feet apart Sunshine, fresh air and moist rich earth are needed for their successful cultivation The scientific name of the common cucumber is *Cucumis sativus*

CUNE'IFORM Probably the oldest system of writing in the world—aside from primitive "picture writing"—is "cuneiform" writing Invented by the ancient Sumerians, it was adopted and used by the Babylonians, Assyrians, and other peoples of western Asia for about 3,000 years It gets its name from the wedge-shaped marks—usually impressed on soft clay tablets which were then baked—which make up its syllabic signs Thousands of such tablets and longer inscriptions have come down to us Since the discovery of the key to this writing, about 1850, our knowledge of the history of the ancient East has been almost completely reconstructed (*See also* Babylonia and Assyria, Writing)

CUPID AND PSYCHE (*sī'kē*) According to one of the most charming myths of the Greeks and Romans, Psyche was the youngest daughter of a king She was so lovely that she aroused the jealousy of Venus, the goddess of love and beauty, who sent her son Cupid (Eros) to the maiden to inspire her with love for some base man But Cupid himself was so impressed with her charms that he carried her away to his palace There he visited her every night, earnestly requesting her not to seek to know who he was Her jealous sisters, working upon her fears and her curiosity, induced her to light a lamp while Cupid was asleep and gaze upon him When she saw that her lover was the handsomest of the gods, in her

excitement she let hot oil fall on his shoulder. He awoke, reproached her, and abandoned her. Psyche then wandered from temple to temple to find the handsome god. In the temple of Venus, this goddess made her perform many difficult tasks. Cupid eventually rescued her, and the gods made her an immortal.

The Romans often pictured Cupid as a blindfolded mischievous boy carrying bow and arrows. The arrows, which he aimed at living creatures, aroused either love or hate. The Greeks called the god Eros and worshiped him as god of both love and friendship.

CURIE (*kū-rē′*), **MARIE** (1867–1934) and **PIERRE** (1859–1906). By discovering radium, Marie Curie and her husband Pierre did much to revolutionize our theories about matter and the universe. They are an inspiring example of a man and wife who lived together and worked together in perfect harmony.

Pierre was the son of a physician, born in Paris May 15, 1859. When he met Marie he was chief of laboratory work at the School of Physics and Chemistry of the city of Paris. He had already made important studies of crystals, including the discovery in 1880 of the piezoelectric effect (*see* Radio; Watches).

Marie was born in Warsaw, then under Russian rule, on Nov. 7, 1867. Her father, Vladislav Sklodovski, taught physics in a Warsaw high school. Marie finished high school at 15 at the head of her class. After several years as a governess, she enrolled, in the fall of 1891, at the school of science of the Sorbonne in Paris. In 1894 she met Pierre at the home of a friend. They were married July 26, 1895.

At that time Henri Becquerel had just discovered radioactivity of uranium, and all physicists were interested. Marie Curie experimented with various minerals until she became convinced that an undiscovered radioactive element existed. Then Pierre joined in her research. In 1898 they announced two new elements, which they named polonium and radium. Pierre took over research into the properties of radium; Marie tried to isolate the new elements. After four years of work in a crude shed, which was their only laboratory, Marie had produced a decigram of radium chloride.

The Curies shared the Nobel prize for physics with Henri Becquerel in 1903 (*see* Nobel Prizes). Soon afterward Pierre became professor of physics at the Sorbonne. Three years later he was run over by a heavy wagon on a Paris street and killed instantly.

Marie devoted the rest of her life to research on radium and radioactivity and to bringing up two daughters, Irene (born 1897) and Eve (born 1904).

CURLING. For hundreds of years, Scotsmen have played a game in which they slide granite stones along a level expanse of ice. This is curling, Scotland's national winter sport. It has spread to many lands, including Canada, the United States, and Switzerland. Teams play this game on a narrow rink 42 yards long. Near each end of the rink is a tee. The tee is the center of four circles, the largest having a radius of 7 feet. A line called the "hog score" crosses the rink 7 yards in front of each tee. Four yards behind each tee is a notch ("hack") to give the players a foothold as they send the stones twisting ("curling") toward the tee at the farther end of the ice (for picture, *see* Winter Sports).

Four men make up a "rink" (team). Each man has two stones and plays each alternately with his opponent. An inning or "head" is counted when both teams have delivered all their stones, and both teams move to the other end of the ice to play the next head. Fourteen heads usually make a game.

To count in the scoring, a stone must rest within the tee's largest circle after all stones have been played. Every stone of one team which is nearer the tee than the nearest stone of the opposition counts one point. A stone failing to cross the hog score is removed until the next head.

A stone weighs between 32 and 44 pounds. It is circular, about a foot in diameter, and flattened at the top and bottom. A handle at the top enables a player to give the stone a twisting motion as it leaves his hands. Two teammates, with brooms, move ahead of the stone to sweep ("soop") the ice in front of the stone. The captain ("skip") of each "rink" directs play. A match or tournament is called a "bonspiel."

CURRANTS. The currants we eat are of two kinds. One kind is a small grape, sweet and seedless, grown chiefly in Greece and Asia Minor, and dried for export. This is the kind we use in cakes and puddings (*see* Raisins). The other kind of currant is not a grape at all; it is a small tart berry grown on shrubby bushes in northern Europe and America. These berries are used for jams, jellies, and pies. The word "currant" is a corruption of the name Corinth. The dried grapes of Greece first came to markets of western Europe from that city. (For illustrations in color, *see* Fruits.)

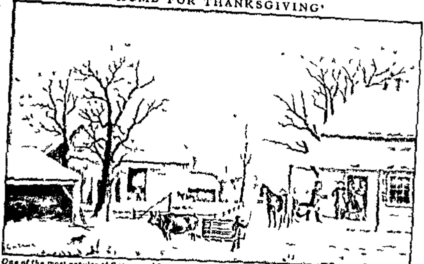
The currant grape is a variety of the common grape, *Vitis vinifera*. The currant berry, however, belongs to the genus *Ribes*, as does the gooseberry. Two common species of the currant berry are the red (*Ribes rubrum*) and the European black (*Ribes nigrum*). White currants are a variety of the red currant. The United States government is discouraging the growing of black currants, for the bushes are hosts to the white pine blister rust, which kills valuable pine trees.

CURRIER AND IVES. What were the exciting news events in 19th-century America? How did Americans look and dress then? Look at a collection of Currier and Ives prints, and you will see the history and people of that time pictured in realistic detail. From 1835 to 1907 the firm of Currier and Ives, lithographers, published about 7,000 different prints that showed nearly every form of American life. The pictures were not offered as great art, but they were very popular. Many Currier and Ives prints sold for as little as 15 cents. Today collectors prize them because they vividly recall bygone days. Some original prints sell for several thousand dollars.

Nathaniel Currier (1813–88) founded the firm in 1835. He was born in Roxbury, Mass., and as a boy was apprenticed to the lithographic house of William

and John Pendleton in Boston When the company moved to Philadelphia, young Currier went along Later a branch office was opened in New York City Currier finished his apprenticeship there, then went into business for himself In 1840 he proved that lithographic methods could depict current news events Three days after the burning of the steamboat *Lexington*, Currier's artists and lithographers gave the public a timely and thrilling picture of the burning ship

'HOME FOR THANKSGIVING'



One of the most popular of Currier and Ives prints is this picture of a New England Thanksgiving shown here in the full colors of the original It was painted by George H Durrie and first published in 1867 Durrie painted many other New England farm scenes for Currier and Ives

James M Ives, (1824–95) entered the firm in 1850 as a bookkeeper He was a native New Yorker He had little schooling, but he had taught himself in libraries and art galleries Ives became a partner in 1857 He knew what the public wanted and had a shrewd eye for technical perfection After the partners died their sons carried on the business until 1907

The prints were lithographed from oil paintings or from pen and ink or wash drawings Some were in black and white only, many others were in color Most of the colored prints were lithographed in one color, then hand colored later Often one print was the work of several artists, with further changes by the lithographer directly upon the stone (*see* Lithography)

CUSTER GEORGE ARMSTRONG (1839–1876) The hero of the 'Custer Massacre' was born in New Rumley Harrison County, Ohio His grandfather was a Hessian soldier who surrendered with Burgoyne then settled in Maryland His father Emmanuel Custer, was a farmer and blacksmith Young Custer attended local schools until he was ten and divided the next seven years between his parents' home and that of his sister in Monroe, Mich He wanted to be a soldier and was appointed to West Point. He was an intelligent but careless student and he was graduated in 1861 at the foot of a class of 34

Assigned to the 2d Cavalry as a second lieutenant, he fought in the battle of Bull Run and helped defend the city of Washington He soon joined McClellan s staff as a captain In June 1863 he was given the wartime rank of brigadier general and served gallantly at Gettysburg and in the Virginia campaigns In 1864 he married his childhood sweetheart Elizabeth Bacon Shortly afterward he was given command of Sheridan's 3d Cavalry Division with the rank of major general His conspicuous dress his fearlessness and endurance made him a celebrity in the Union army

When the Civil War ended Custer returned to his regular rank as captain Promotion was slow After ten years of Indian campaigns he was only a lieutenant colonel Rash and headstrong he was in trouble with his superiors At a public hearing in Washington in 1876 he offended President Grant by condemning the War Department s Indian policy and the frauds connected with it Only the pressure of favorable public opinion made it possible for him to take part in the expedition against the Sioux then being organized

The expedition left Fort Abraham Lincoln N D in May 1876 under Gen Alfred H Terry It was directed against the forces assembled by Sitting Bull in Montana On June 24 scouts reported an Indian village in a bend in the Little Big Horn River Terry sent Custer with 600 men to bar their escape to the east until the rest of the troops could get there The next morning Custer believing the Indians few in number decided to disregard his orders He sent a detachment under Capt Frederick Benteen toward the left to explore the territory south of the river bend Shortly afterward Custer topping a rise sighted the village Again he divided his force and sent a column under Maj Marcus A Reno to approach the Indian camp along the west bank of the river With the remainder of his force Custer sped forward

Unknown to the whites Sitting Bull s forces numbered about 6 000 Most of them lay in ambush in the hills around the village Reno was driven back with a loss of 56 men and retreated to a high bluff Benteen hearing gunfire hastened to Reno s assistance Their combined forces held off the Indians until Terry s column arrived the next day No word had come back from Custer When the Indians withdrew on June 27 the soldiers went forward On a slope to the west of the village they found the bodies of Custer and his 208 men Not one lived to tell of the battle

CUTWORM. On spring nights, armies of these fat caterpillars crawl from the ground to attack farms and gardens. Some are nearly all black, gray, brown, or green; others are striped or spotted. But all have large pincer-like jaws with which they snip off tender young shoots at or near the ground. A single cutworm clips off four or five plants in a night, destroying far more than it eats. In the United States, these pests have been known to destroy millions of dollars' worth of vegetables, wheat, corn, seedling trees, and other plants within a few months.

Cutworms are the young of certain moths of the family *Noctuidae* (named from the Latin *noctua*, meaning "owl"). The adults are often called "owlet moths" because they fly by night and some have eyes that glow in the dark. Their more popular name is "miller" or "moth miller."

Life Cycle of the Cutworm

In late summer the female moth lays from 200 to 500 eggs on plant leaves or on the ground. The *larvae*, or cutworms, hatch out in a few days and feed upon tender shoots. As cold weather nears, they burrow into the ground and sleep during winter. When spring comes they attack the growing vegetation. They hide in the soil by day and eat by night. Sometimes they climb into trees and vines and eat young leaves or fruit. In late spring when they are full grown, they form chambers in the ground and there turn into *pupae*. In summer they emerge as moths. Some species produce two generations in a single year, and a few spend the winter in the pupal state.

Cutworms can be killed with poisoned bran. A mixture of 25 pounds of wheat bran, one pound of Paris green or white arsenic, two quarts of cheap molasses, and two gallons of water is enough to sprinkle three or four acres. This mixture must be kept out of the reach of children, poultry, and live stock. One way to protect a young tomato or cabbage plant from cutworms is to encircle the plant stem in a piece of stiff paper, reaching an inch or so into the ground.

Some of the species are the spotted cutworm (common in the United States and Europe), *Agrotis c-nigrum;* greasy cutworm, *Agrotis ypsilon;* olive-green cutworm, *Neuria procincta;* variegated cutworm, *Peridroma margaritosa* or *Lycophotia margaritosa.*

CUVIER (*kū'vĭ-ā*), **GEORGES, BARON DE** (1769–1832). During the troubled days of the French Revolution and the Napoleonic era, Cuvier was laying the foundations of the science of comparative anatomy. This science, now called comparative morphology, studies the structure of animals to discover their relationships. (*See* Anatomy; Zoology.)

Cuvier was so curious about the structure of animals that he undertook to dissect specimens from every important group in the animal kingdom. He did not stop with merely observing details of structure. His main purpose was to discover relationships by comparing the structures of the various groups.

From the time of Linné, animals had been classified by their *outward* appearance (*see* Linné). But Cuvier found that some of the so-called higher animals are less highly developed than some which were placed low in the "scale of being." He therefore reclassified animals on the basis of their *internal* structure.

Another of Cuvier's great contributions was the statement of the principle of "correlation of parts." This means that the parts of an animal are so closely related that a change in one part may involve a change in another. For example, in developing teeth for cropping and chewing grass, cattle and other ruminants have developed a special form of stomach for digesting grass (*see* Ruminants). But the flesh-tearing teeth of a tiger are associated with a stomach that readily digests flesh.

His Life and Chief Works

Cuvier was born Aug. 24, 1769, at Montbéliard, France. He early showed joy in study and a special liking for natural history. While a student at the Carolinian Academy at Stuttgart, he read nearly all the scientific books in the library and learned how to dissect animals. From 1788 to 1794, Cuvier put this art to good use in the study of marine animals. During these years he was tutor with a family living on the coast of Normandy. Here he met the Abbé Tessier, a keen student of natural history, who urged the young man to go to Paris and seek greater opportunities.

In Paris, Cuvier rose rapidly to fame. He was made assistant professor of comparative anatomy at the Jardin des Plantes in 1795 and full professor in 1802. From 1800 to 1805 he issued, in five volumes, his famous treatise on comparative anatomy, the first treatise to systematize this study. His work on the fossil bones of quadrupeds (1812) established the science of vertebrate paleontology. In 1816, he issued his greatest book, the title of which may be translated as 'The Animal Kingdom Arranged According to Its Organization'. This upset forever the old system of classifying animals. In 1818, he was elected to the French Academy.

Napoleon appointed him inspector of education in 1802, a council member of the Imperial University in 1808, and a councilor of state in 1814. In recognition of his services, he was made a grand officer of the Legion of Honor in 1826 and a baron in 1831. He died in Paris May 13, 1832.

CYANIDES (*sī'ă-nīds*). A cyanide is a salt of hydrocyanic acid, which is also called prussic acid (HCN). The new element or compound replaces the hydrogen of the acid and produces compounds such as sodium cyanide (NaCN) and potassium cyanide (KCN). Cyanides are extremely active chemically. Hence they are useful to industry and also highly poisonous.

Their ability to seize metals is used to extract gold and silver from ore (*see* Gold). Cyanides make excellent solutions for electroplating gold or silver (*see* Electroplating). Melted sodium cyanide is used for *case hardening* of iron and steel. The metal is placed in the melted cyanide, and it absorbs carbon into its outer layer. This *cyaniding* gives a hard surface to the metal. Complex double cyanides of iron and

potassium, called potassium ferrocyanide and potassium ferricyanide, are useful in dye industries. The latter forms part of the sensitive coating of blueprint papers. Prussian blue is a complex cyanide of iron with or without potassium.

Cyanides are poisonous to both plants and animals because they absorb oxygen even from individual cells. In animals this action causes asphyxiation, heart failure, and death. The only chance to save a victim is to get him into pure air and apply artificial respiration. To kill rats and other vermin and to rid trees of insect pests, hydrocyanic acid is used rather than a cyanide, because it is a gas.

In chemistry, the term cyanide is commonly used for salts of a metal or alkaline element. Compounds with organic radicals such as ammonium are often called *nitriles*. When the cyanogen radical CN combines with OH instead of H, the compound is called cyanic acid, and its salts are called *cyanates*. Many plants such as sorghum and flax and plant parts such as almonds and peach pits contain cyanogen. It is combined with glucose as a *glucoside* and is harmless, except when decay of the plant breaks up the combination. Then the plant may be poisonous.

CYCLAMEN (*sik la men*). Of the potted plants the cyclamen is almost unsurpassed for delicate beauty. When fully opened the flower has turned itself inside out until the face looks downward and the petals point upward. The petals, five in number, are red, white, purple, rose pink, or salmon, and sometimes of two colors. The large kidney shaped leaves are mottled like marble or bear attractive designs of stripes and splashes. Each leaf and flower has its own stalk which springs directly from the large tuberous root.

Florists raise the plants from seed sown during August. It takes 15 months for the blooms to appear. Since the cyclamen may not flower well a second season, new plantings are made annually. The plants should be watered every day while in bloom and should be kept in a cool room.

The cyclamen forms a genus of the primrose family (*Primulaceae*). The few species are native to southern Europe and Asia, but florists everywhere have developed handsome varieties. Many of the florists' varieties come from the species *Cyclamen indicum*.

CYCLONE. In common speech the word "cyclone" is used to mean a tornado, a hurricane, or any destructive wind storm. In weather science the word means a certain definite arrangement of winds over a large area, hundreds of miles wide. The winds all blow spirally inward toward a center where the barometric pressure is low. The winds may be thought of as pushing the center around, and the rotation will be counterclockwise in the Northern Hemisphere and clockwise south of the equator (*see* Storms). An *anticyclone* is the opposite of a cyclone. In such a system the winds blow spirally outward from a high pressure center with direction of rotation the reverse of the cyclone's.

CYCLOPS (*si klŏps*), plural form, **Cyclopes** (*si-klo pez*). In Greek mythology the Cyclopes were giants with a single round eye in the middle of the forehead. Some legends said they were builders and assistants to Hephaestus, the god of fire and metal making, but older traditions say they were lawless shepherds who devoured human beings and cared nothing for the gods.

The man-eating Cyclopes were said to live in caves high in the mountains of Sicily. In the 'Odyssey', Homer tells what befell Odysseus and his men who blundered into the cave where lived Polyphemus, the most famous of the Cyclopes (*see* Homer; Odysseus).

The Greeks Meet the Giant Polyphemus

Unaware that the island belonged to the Cyclopes, Odysseus with 12 men had gone ashore to learn who lived there. When they reached the cave, Odysseus led the way in, carrying a huge jar of wine as a present. No one was home, but the cave was stored with food, so the hungry adventurers fell to feasting.

Suddenly a shadow darkened the entrance. In raced a flock of sheep and goats driven by Polyphemus. He closed the entrance with a stone that 20 horses could not have moved. In the darkness his one eye glared like a ball of fire. He swung a club as big as a ship's mast, killed two of Odysseus' men with one blow, and ate them for supper. Then he slept.

Odysseus refrained from killing the sleeping monster because no one but the giant could move the stone. Polyphemus ate two more men for breakfast before he went out with his flocks. He closed the entrance again, leaving Odysseus and his men prisoners.

A plan of escape now occurred to the crafty Odysseus. After two more of his men had been eaten for supper, he poured wine from his jar into a bowl and offered it to the giant. Polyphemus, delighted with this new drink, called for more and asked the stranger his name. Odysseus supplied him again and again, and answered, "Noman is my name." Soon the giant fell into a drunken sleep. Odysseus and his men took a piece of the monster's huge staff, sharpened it to a point, heated it in the fire, and put out his one eye.

Polyphemus bellowed like a hundred bulls. His brother Cyclopes rushed to the door of the cave. When he cried out, "Noman is slaying me," they replied, "If no man hurts you, the blow must be sent by the gods, and we can do nothing," so they left him to his fate.

How Odysseus and His Men Escaped

Next morning Polyphemus rolled away the stone to let out his sheep and placed himself at the opening of the cave to catch the intruders if they should try to escape. But Odysseus had tied the sheep in threes, and beneath each three he had tied one of his men. He himself hung under the body of a great ram, clinging with hands and feet. When the flocks hastened forth to pasture, Polyphemus passed his hands only over the backs of the animals, and so Odysseus and his six men escaped to the ship.

Polyphemus made Odysseus pay dearly for his escape. The monster asked his father Poseidon to stir up the waters so that Odysseus could never find his way home to Greece. The sea god heard the plea and made Odysseus a wanderer for ten long years.

WHERE GIANT CYPRESSES GROW

A cypress swamp like this one of the deep South is a place of mystery and strange beauty. Spanish moss hangs ghostlike from the branches. Notice the curious growths ("knees") that the cypress throws up from its roots.

CYPRESS. From the heartwood of southern cypress trees, American pioneers built churches and plantation homes that may be standing long after our own day. Cypress, indeed, is one of the most durable of all woods. It resists insects and chemical corrosion as well as decay. Things made from it range from houses and coffins to acid tanks and butter vats. Other cypress products are boat planking, docks, pilings, poles, railroad ties, garden furniture, and flower boxes.

We get cypress lumber from the southern or bald cypress, a native of coastal swamps from Delaware through Texas, and of Mississippi Valley bottomlands as far north as southern Illinois and Indiana. It grows big enough to be used for lumber in two centuries, and it may live more than 12 centuries. Some specimens are 8 feet in diameter and 150 feet tall, with a limb spread of 80 feet. In swamps, the roots spread out for support. Some of them send up kinks called "cypress knees" above the water to get air. The branches bear light-green needlelike leaves three-quarters of an inch long and round cones the size of walnuts The leaves are shed in fall (hence the name bald cypress). The heartwood is easy to work yet fairly strong. It varies in color from dark red at tidewater to almost white for inland trees. Florida leads in cypress lumber production, followed by Louisiana, Mississippi, Arkansas, Georgia, and South Carolina.

The Italian cypress, a tall candle-shaped evergreen of Mediterranean shores, also yields wood that lasts for centuries. The cypress doors of St. Peter's Church in Rome served for 1,100 years and were still sound when replaced by doors of bronze.

On the cliffs of the Bay of Monterey in California grows the Monterey cypress, its crown whipped flat by ocean winds. It is too scarce to be a source of lumber.

Other cypresses of the Pacific coast are the Port Orford cedar (Lawson's cypress) that grows 200 feet tall, and the Alaska cedar (Sitka or yellow cypress). Their durable wood is sold as cedar.

Cypress trees are conifers All those discussed above, except the southern or bald cypress, retain their leaves the year round Scientific name of southern cypress, *Taxodium distichum,* Italian cypress, *Cupressus sempervirens,* Monterey cypress, *Cupressus macrocarpa;* Port Orford cedar, *Chamaecyparis lawsoniana;* Alaska cedar, *Chamaecyparis nootkatensis.*

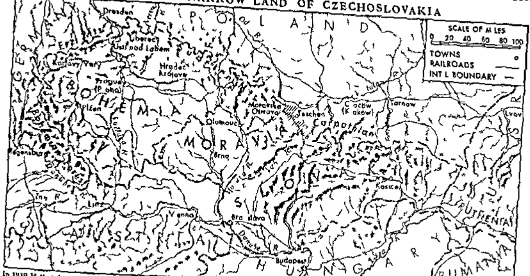
CYPRUS. A world center of commerce and learning in ancient times, but almost forgotten today, this island lies in the Mediterranean Sea, west of Syria. After Sicily and Sardinia, it is the largest of the Mediterranean islands. It covers 3,591 square miles

Mountain ranges in the north and south hem in the broad Mesaoria plain. The hot summer sun dries up the soil and much of it must be irrigated for farming. Exports include carob beans, oranges, raisin and wine grapes, potatoes, mules, copper, iron, pyrites, and asbestos. Cyprus was famous for copper in ancient times, and the metal was named for it (*see* Copper).

Cyprus was conquered in turn by Egypt, Phoenicia, Greece, Persia, and Rome, and became part of the Byzantine Empire. It was Christianized by St. Barnabas, who visited it with St. Paul. During the Third Crusade it was conquered by Richard I of England and was ruled by members of the crusading orders for three centuries. In 1489, it was taken by Venice, and in 1573, by Turkey. In 1878, England leased Cyprus from Turkey, and, in 1914, annexed it. The island now serves England as an outpost for defense of the Suez Canal.

About four-fifths of the people are Greeks, nearly all the rest are Turks Population of Cyprus (1946 census), 450,114; of Nicosia, the capital, 34,485.

THE LONG NARROW LAND OF CZECHOSLOVAKIA



In 1939 Hitler dismembered Czechoslovakia. When it was put together again in 1945 its government ceded the eastern province Ruthenia to Russia. But it refused to sanction Poland's seizure of the Teschen area in the north, rich in coal and iron. In the south Czechoslovakia gained from Hungary a small bridgehead on the Danube opposite Bratislava.

CZECHOSLOVAKIA (*chĕk'o-slo-väk'ĭ-ȧ*). In 1918 a new nation arose in an important old land in the mountainous heart of Europe. Since prehistoric times, the rugged upland of Bohemia had been an important center and crossroads. For four centuries it had lain under Austrian rule, but even before the end of the first World War the victorious Allies entrusted the land to a new nation named Czechoslovakia.

The name of Czechoslovakia means "land of the Czechs and Slovaks." The Slovaks occupy the eastern part of the country (Slovakia). The Czechs live in the center (Moravia) and the west (Bohemia). Both peoples are Slavs and both are predominantly Roman Catholic. But they differ in culture and in historical background.

The Czechs are the most westerly branch of the Slavs. By the 14th century they had acquired Western cultures and had won a high place in Europe (*see* Bohemia). After a long and bitter struggle they succumbed to Austrian rule in 1526. The resulting Germanic influence made them an industrial people more advanced in culture than the Slovaks. They boast a long roll call of famous names: John Huss, a religious leader of world renown; Antonin Dvořák and Friedrich Smetana, composers; Jan Kubelik, violinist; Johann Comenius, educational reformer; and Karel Capek, dramatist and essayist.

The Slovaks fell under the rule of Hungary. Like the rest of the eastern Slavs, they gain their living chiefly by farming.

The Land and Its Resources

Czechoslovakia covers an area about the size of New York. Bohemia, in the west, is a fertile rolling plateau, almost enclosed by mountain ranges. Moravia, in the center, occupies a hilly depression open to the north and south. Slovakia, in the east, slopes down from the Carpathian Mountains in the north to a broad prairie land. The climate is continental, with sharp seasonal changes.

Although Czechoslovakia is an inland country, it has easy access to the sea. The Elbe and the Oder rivers flow to the north. The Morava leads south to the Danube along the southern boundary. Railways link the country with all parts of the continent.

Wooded mountains cover a third of the land. Intense cultivation of the lower slopes and valleys makes the nation almost self-sufficient in food. The chief farm products are potatoes, sugar beets, wheat, rye, barley, oats, hops, and fruits.

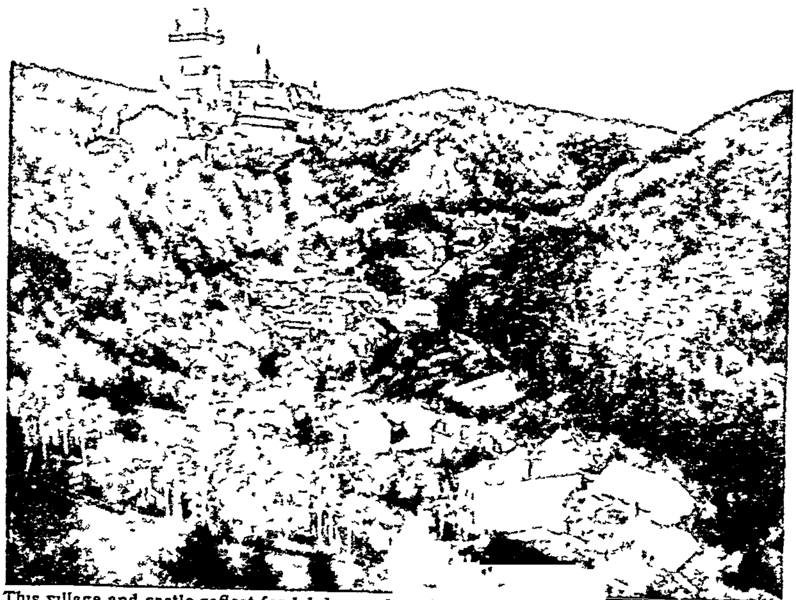
The Erzgebirge (Ore Mountains) in Bohemia and the Silesian basin in the Oder Valley in Moravia are rich in coal and lignite. Mines in Bohemia yield iron, graphite, garnets, and silver. Slovakia has copper, lead, and rock salt. Industry is concentrated in Bohemia and Moravia. The chief products are machinery, munitions, glassware, and fine porcelain, beer, textiles, costume jewelry, shoes, and gloves. Plzen (Pilsen), which gave its name to Pilsener beer, is the seat of the huge Skoda armament plant.

Even before Czechoslovakia became Communistic in 1948 the government owned nearly all the industries. Farms were privately owned, but the Communists have set up village collectives in an effort to socialize farming. Education is widespread. There are three universities—at Brno in Moravia, at Bratislava in Slovakia, and at Prague, the capital, in Bohemia (*see* Prague). The people like mass gymnastics, which they practise in organizations called *sokols*.

History of the Czechoslovak Republic

Czechoslovakia came into being on Oct. 28, 1918, following the collapse of the Austro-Hungarian Em-

A VILLAGE IN THE FORESTED HILLS



This village and castle reflect feudal days, when the villagers lived along the narrow valley bottom under the eye of the ruler on the hill. The village is near Prague. It was named for the adjoining castle of Karlstein, built by Charles IV in the 14th century.

pire (*see* Austria-Hungary; World War, First). It owed its birth largely to Thomas Masaryk, who had crusaded among the Allies for the liberation of his people. Masaryk was elected first president in 1920, and he guided the young republic until 1935.

The chief problem of the young republic was its minority peoples. The Czechs numbered some 8 million, the Slovaks about 3 million. More than 3 million Germans, called "Sudetens" from one of the mountain ranges, lived in Bohemia and Moravia. Hungarians were numerous in southern Slovakia. Poles lived in the district around Teschen, a coal-mining town on the Polish border. The eastern tip of the country contained Ruthenia, with a population which felt kinship with the Ukrainians of Russia.

Masaryk began at once to break up the large estates (many of which were owned by Germans) and distributed the land to the peasants. Opportunities for education were widened. The government, modeled on that of the United States, was liberal and democratic. But the Sudeten Germans, who had been the masters in the old empire, could not reconcile themselves to their new rôle as a minority people. When Hitler came into power in Germany, many of them joined a Nazi party to win union with the Reich.

After seizing Austria in March 1938, Hitler turned to Czechoslovakia. In September, Great Britain, France, and Italy met with him in the famous Munich conference. To avert war, Great Britain and France reluctantly agreed on September 30 to let Germany occupy the Sudeten districts. Within six months, on March 15, 1939, Hitler broke the pact and sent troops into Prague. He incorporated Bohemia and Moravia into Germany and made Slovakia a nominally "independent" German protectorate. He allowed Hungary to take over Ruthenia, and permitted Poland to move into the Czech area of Teschen.

Czechoslovakia remained dismembered throughout the second World War. Eduard Benes, who had followed Masaryk as president, set up a government in exile in London and the Czechs remained defiant, despite stern repression. When Reinhard Heydrich, a German police general, attempted to stamp out resistance, he was assassinated. Suspecting the Bohemian village of Lidice of harboring his assassins, the Nazis razed it and shot all the men and 56 women (June 10, 1942).

In May 1945 the Russian army reached Prague and the American forces occupied western Bohemia. The Americans left in November, but part of the Russian army stayed. President Benes' government, a coalition of Socialists and Communists, pledged co-operation with Russia and transferred Ruthenia to the Russian Ukraine. In 1947 the Hungarian peace treaty gave Czechoslovakia a foothold opposite Bratislava, and Poland gave the Czechs permission to use the port of Szczecin (Stettin). Trying to avoid another Sudeten crisis, Czechoslovakia expelled Germans. After Hungary refused to exchange minorities, the Czechs moved alien Hungarians to the interior.

The Czechs' restored democracy worked well. Then in 1948 Communists seized control. President Benes was forced to resign. Czechoslovakia's plight drove the Western powers to increase aid to democracies (*see* Europe). Neither the compulsory collective farms nor state-controlled industry equaled Czechoslovakia's production when it was a democracy, and living standards fell. In 1954, however, the Czechs made trade pacts with West Germany and the Netherlands.

Area of Czechoslovakia, 49,373 square miles; population (1950 census, preliminary), 12,339,674. (For Reference-Outline and Bibliography, *see* Europe.)

THE EASY REFERENCE FACT-INDEX

GUIDE TO ALL VOLUMES FOR SUBJECTS BEGINNING WITH

C

TO SAVE TIME

USE THIS INDEX

EDITOR'S NOTE ON NEXT PAGE TELLS WHY

SPECIAL LISTS AND TABLES

Numerous other lists and tables in the fields of geography, history, literature, science, mathematics, and other departments of knowledge will be found with their appropriate articles in the main text

EDITOR'S NOTE

EVERY user of Compton's Pictured Encyclopedia should form the habit of *first* turning to the Fact-Index section at the end of each volume when in search of specific information. This index is a miniature work of reference in itself and will often give you directly the facts, dates, or definitions you seek. Even when you want full treatment of a subject, you will usually save time by finding in the index the exact page numbers for the desired material.

All page numbers are preceded by a letter of the alphabet, as A-23. The letter indicates the volume. If two or three page numbers are given for the topic you are seeking, the first indicates the more general and important treatment; the second and third point to additional information on other pages. Where necessary, subheadings follow the entry and tell you by guide words or phrases where the various aspects of the subject are treated.

The arrangement of subheadings is alphabetical, except in major historical entries. In these the chronological order is followed.

The pictures illustrating a specific subject are indicated by the word *picture* or *color picture* followed by a volume indicator and a page number. A picture reference is frequently intended to call attention to details in the text under the illustration as well as to the illustration itself. This picture-text, therefore, should always be carefully read. The pictures are usually on the same page as the text to which you are also referred; sometimes they are found in a different but related article which will add interest and information.

The pronunciations given are those preferred by the best and most recent authorities; alternative pronunciations are indicated where usage is divided.

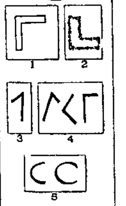
In recent years hundreds of foreign geographical names have been changed, either officially or by custom. Both old and new names are given at the appropriate places in the alphabet.

Populations are those of the latest census or an official estimate when available if no census has been taken since World War II. Distances between points are map or air distances, not distances by railroad.

THE EASY REFERENCE FACT-INDEX

Reg. U. S. Pat. Off.

C



Our letter C probably started in ancient Egypt as a sign for an angle in a wall (1). Soon after 2000 B.C. a Semitic people called the Semites adopted a crude version (2) of this picture as an alphabetic sign for the hard sound of g (as in gay) because to them the sign looked like a carpenter's square and their name gimel for a square began with this sound.

Later the Canaanite Phoenician alphabet simplified the sign to an angle (3). In Hebrew and other Semitic languages the name remained *gimel*.

The next change came when the Phoenicians taught the Greeks how to write. The Phoenician *gimel* was shaped for writing in Semitic fashion from right to left. When the Greeks came to write from left to right they turned the sign around to suit this style. They also straightened it up (4) and renamed it *gamma*.

The Romans took over this sign into Latin but rounded it (5). This brought into existence our sign C which the Romans at first used for the k sound. We still do this when *c* comes before *a*, *o* or *u* as in cash and also before consonants other than *h* as in clean. But they also used the letter K for this sound and thus they had two signs for the same sound. But they lacked a sign for the hard sound of g and so to meet this need they gave the old C a tail as told in the history of the letter G. This still left the original sign C available for another sound and in medieval times it came to be used for the soft sound of *c* before *e*, *i* and *y* as in cent.

Note.—For the story of how alphabetic writing began and developed *see* the articles Alphabet, Writing.

Caaba or **Kaaba** Mohammedan shrine M 157 *picture* M 157

Caatinga (*kä a ting gä*) forest in Brazil B 291 S 271 275 *map* S 255

CAB (Civil Aeronautics Board) *See in Index* Civil Aeronautics Board

Cabal (*kȧ băl*) organization engaged in secret intrigues particularly an unpopular English ministry (1667 73) under Charles II composed of Clifford Ashley Buckingham Arlington and Lauderdale whose initials happened to form the word

Cabala (*kăb ȧ lȧ*) or **Kabbala** mystical interpretation of Scriptures H 327

Caballero (*kä bäl yä rō*) **Fernán** pen name of Cecilia Böhl von Faber (*fä bĕr*) (1796–1877) Spanish novelist born Switzerland wrote of native customs folklore ('The Sea Gull')

Caballos Honduras *See in Index* Puerto Cortes

Cabanel (*kȧ bȧ nĕl*) **Alexandre** (1823–89) French painter celebrated and highly popular in his time for portraits and historical paintings academic in treatment

Cabbage C 1 2 *pictures* A 134 C 1–2
cooking C 466
cutworm protection from C 532
odor S 447
when and how to plant G 13 *table* G 19

Cabbage butterfly or **white butterfly** (*Pieris rapae*) of the order *Lepidoptera* family *Pieridae* larva a pest on cabbage and cauliflower *color picture* I 154c
eggs *picture* E 269

Cabbage palm name applied to certain palms such as the coconut palm and royal palm which bear large terminal buds that are eaten like cabbage *picture* P 49

Cabbage rose R 230

Cabbage worm a caterpillar C 137

Cabell (*kăb l*) **James Branch** (born 1879) novelist born Richmond Va engaged in genealogical and historical research works show classical attention to form and structure subtly humorous ironical fantasies set in imaginary medieval country Poictesme ('Cream of the Jest' 'Jurgen' 'Straws and Prayer Books' 'The Silver Stallion' 'Beyond Life')

Cabeza de Vaca (*kä bā thä dä vä kä*) **Alvar Núñez** (1490 1557) Spanish soldier and explorer C 3
wanderings in Southwest S 307
New Mexico N 181, Texas T 93

Cabezon (*kăb i zŏn* or *kä bā sōn*) a fish (*Scorpaenichthys marmoratus*) of the Pacific coast green in color even to the flesh and bones handsome and hardy in aquariums

Cabildo (*kä bēl dō*) in French Quarter New Orleans erected 1795 as seat of governing body ('cabildo') for Spanish province of Louisiana scene of transfer of Louisiana territory from France to U S Dec 20 1803 following Louisiana Purchase residence of Lafayette during visit 1825 now a museum of history and art

Cabinda, or **Kabinda** (*kä bēn dä*) Portuguese possession n of mouth of Congo River belongs to colony of Angola 3000 sq mi pop 46 284 *maps* B 109 A 47

Cabinet in government, the heads of departments who act as advisers to the chief executive of a country or state C 3–4 A list of members of the Cabinet of the President of the U S will be found on next page
British C 4 P 87–8
Canadian C 91 92
Confederate States of America C 433
United States C 3 4 *list* U 359
executive departments U 358–67
first Cabinet, *picture* C 3 salaries *table* U 357

Cabinet government *See in Index* Parliamentary government

Cable George Washington (1844–1925) novelist born New Orleans La stories of Creole life and old plantation days in the South ('The Grandissimes' 'Old Creole Days' 'Strange True Stories of Louisiana') A 229

Cable
coaxial R 41 television T 54a *diagram* T 54a
in dam building D 11
undersea C 5 8 *map* C 5 *pictures* C 5–8
Atlantic Ocean C 5 *map* A 452
gutta percha as covering G 235 C 6 *diagram* C 6
sending a message C 6 *picture* T 38
wire W 161 163 *picture* W 162
aluminum A 182

Cable railway S 430 *pictures* C 198 S 41b

Cable tool drill for oil wells P 171

Cabochon (*kȧ bō shōn*) a method of gem cutting which gives jewels a domelike appearance used for all stones until 14th century when faceted cut became popular still used for opaque and translucent stones and for carbuncles J 347 *picture* J 350

Caboose a railroad car at end of freight or construction trains used for train crew or workmen *picture* R 69a

Cabot Frederick P (1868 1932) lawyer born Brookline Mass
Boston juvenile court J 368

Cabot George (1752–1823) one of Federalist leaders in Mass president of Hartford Convention and member of Essex Junto

Cabot John (1450–99?) Italian explorer sailing under English flag C 8 9 C 95
St George's Cross (flag) F 136a *color picture* F 131
voyages *map* A 189

Cabot Richard Clarke (1868 1939) physician and writer born Brookline Mass professor of medicine and of social ethics Harvard University author of books on medicine and on ethics

Cabot Sebastian (1476–1557) explorer son of John C 9 A 337

Cabot Strait between Newfoundland and n Cape Breton Island connects Gulf of St Lawrence with Atlantic Ocean *map* C 73

PRESIDENT EISENHOWER'S CABINET

Secretary of State

John Foster Dulles. Lawyer and diplomat, born Washington, D.C., 1888; with law firm of Sullivan and Cromwell, New York City, 1911–49, interim U.S. senator 1949, special representative of president of U. S. to negotiate Japanese peace treaty 1950–51.

Secretary of the Treasury

George M(agoffin) Humphrey. Industrialist and lawyer, born Cheboygan, Mich., 1890, joined M. A. Hanna Company, Cleveland, Ohio, 1918, president 1929–52, chairman of board May-Dec. 1952.

Secretary of Defense

Charles Erwin Wilson. Industrialist and electrical engineer, born Minerva, Ohio, 1890, with Westinghouse Electric and Manufacturing Company 1909–19; joined General Motors Corporation 1919, became president 1941, chief executive officer 1946–52.

Attorney General

Herbert Brownell, Jr. Lawyer and political leader, born Peru, Neb., 1904, manager for Thomas E. Dewey's presidential campaigns 1944 and 1948, chairman Republican National Committee 1944–46, played key role as strategist in Dwight D. Eisenhower's presidential campaign 1952.

Postmaster General

Arthur E(llsworth) Summerfield. Political leader, born Pinconning, Mich., 1899, in 1929 opened automobile agency at Flint, Mich., now one of largest in U.S.; chairman Republican National Committee July 1952–Jan. 1953.

Secretary of the Interior

Douglas McKay. Public official, born Portland, Ore., 1893; established automobile sales business at Salem, Ore., 1927; mayor of Salem 1933–34; state senator 1935–37, 1939–41, 1943–45, 1947–49; governor 1949–52.

Secretary of Agriculture

Ezra Taft Benson. Farm-marketing specialist, born Franklin County, Idaho, 1899; extension marketing specialist University of Idaho 1930–38, executive secretary National Council of Farmer Co-operatives 1939–44; member, quorum of 12 apostles of Mormon church 1943–52.

Secretary of Commerce

Sinclair Weeks. Manufacturer, born West Newton, Mass., 1893; president Reed and Barton Corporation, Taunton, Mass., 1923–44, chairman of board 1945–53; mayor Newton, Mass., 1930–35, interim U.S. senator 1944, chairman Republican national finance committee 1949–53.

Secretary of Labor

James P(aul) Mitchell. Business executive, born Elizabeth, N. J., 1902, vice-president (personnel and labor relations) Bloomingdale Brothers, New York City, 1947–53; assistant secretary of the army (manpower) 1953, appointed Oct. 1953 to replace Martin P. Durkin, who resigned.

Secretary of Health, Education, and Welfare

Marion B(ayard) Folsom. Business executive and government official, born McRae, Ga., 1893; joined Eastman Kodak Company 1914, treasurer 1935–53; undersecretary of treasury 1953–55; appointed July 1955 to replace Oveta C. Hobby, who resigned.

Caerleon (*kär'lē ŏn*) England town on Usk River near border of s Wales site of ancient Roman fortress of Isca history and plan of which have been revealed by excavations many Roman antiquities found traditional site of Camelot seat of King Arthur's court
Caeruleum (*sē rū lē ŭm*) ancient name for azurite J 349
Caesar (*sē zẽr*), **Gaius Julius** (102?–44 B C) Roman general statesman and author C-13–15 *pictures* R 183, C 14
calendar reforms C 22 D 28 Y 335
Cleopatra and C 343, *picture* C 343
conspiracy against, and death C 14–15
dictator with title of imperator C 14
invades Britain L 357
July named for J 364
literary style C 15 L-130–1
name as official title C 15
Pompey and P 368
Caesarea (*sĕs a rē ă*), or **Caesarea Mazaca** ancient town in Asia Minor capital of kings of Cappadocia destroyed by Persians A D 260 pop then 400 000 modern town Kayseri trade center in e Turkey pop 65 489 *maps* P 156 T 215
Caesarea Philippi town in ancient Palestine on Jordan River at foot of Mt Hermon here Jesus gave His charge to Peter (Matt xvi 13–19) now the village of Banlyas Syria *map* B 138
Caesarion or **Ptolemy XIV** (died 30 B C) son of Cleopatra and ruler with her of Egypt P 430 C 343
Caesium *See in Index* Cesium
Caesobriga Spain *See in Index* Talavera de la Reiña
Café (*kă fā*) C 379
Café au lait (*ō lā*) C 379
Caffeine (*kăf ē in*) also caffein a drug found in coffee C 379–80 T 30
heart and brain stimulant T 30
Caffre cat C 136b
Cagliari Paolo *See in Index* Veronese Paolo
Cagliari Italy capital and chief city of Sardinia on s coast on Gulf of Cagliari pop 137 040 Roman amphitheater also name of a province of Sardinia *maps* I 262 E 425
Cagliostro (*käl yōs trō*) **Alessandro** Count assumed name of Joseph Balsamo (1743–95) Italian adventurer traveled widely in Europe and Asia posing as physician alchemist writer freemason implicated in Diamond Necklace affair and exiled from France in Rome Inquisition charged him with heresy and sorcery and sent him to prison where he died
Cahaba (*ka hạ bu*) Ala town at junction of Alabama and Cahaba rivers 10 mi s of Selma state capital 1820–26 now deserted
Cahan (*ka han*) **Abraham** (1860–1951) American journalist and author born Russia came to U S 1882 editor in chief *Jewish Daily Forward* (*Yekl a Tale of the New York Ghetto* *White Terror and the Red* *The Rise of David Levinsky*)
Cahiers (*kä yā*) writs of plaints and grievances drawn up by legislative representatives of villages and towns of France shortly before Revolution of 1789
Cahokia Ill village about 5 mi s of East St Louis pop 794 I 41 *map inset* I 37
Clark captures C 339
Cahokia Mounds M 438 I 27 *pictures* I 41 M 438
Cahow (*ka hạ* or *kă hou*) a petrel P 187

Caiaphas (*kā ya fas*) Jewish high priest, before whom Jesus was arraigned preceding the crucifixion (John xviii 13–14 24)
Caicos Islands Bahamas *See in Index* Turks and Caicos Islands
Caillaux (*kä yō*) **Joseph M A** (1863–1944) French premier 1911–12 imprisoned 1917–20 banished 1920–25 for treasonable communication with the Germans minister of finance 1925 and for short period in 1926 and in 1935 became senator 1926 His wife killed Gaston Calmette editor of *Figaro* for printing virulent attacks against Caillaux but was acquitted
Cailletet (*kä yə tā*) **Louis Paul** (1832–1913) French chemist succeeded in liquefying oxygen and nitrogen
Caiman or **cayman** reptile of the crocodile type C 515
Cain (*kān*) Adam and Eve's first born son slayer of his brother Abel (Gen iv)
Cain James M(allahan) (born 1892) journalist and author born Annapolis Md hard boiled novels some made into motion pictures (*The Postman Always Rings Twice* *Double Indemnity* *Serenade* *Mildred Pierce*)
Caine Sir Hall (1853–1931) English novelist dramatist and biographer stories melodramatic with religious tone (*Recollections of Rossetti* *Life of Coleridge* *The Manxman* *The Christian* *The Eternal City* *The Woman Thou Gavest Me* *Master of Man* *The Woman of Knockaloe*)
Isle of Man scene of novels M 71
Cairngorm Scottish topaz or smoky quartz a semiprecious stone J 349
Cairngorm Mountains Scotland between Inverness and Banff shires highest peak 4095 ft proposed as a national park
Cairn terrier *table* D 118b
Cairo (*kī rō*) or **El Qahira** Egypt largest city in Africa on Nile River pop 2 100 506 C 15–16 *maps* E 271 A 46 A 531 *pictures* C 15–16 E 276
American library *picture* L-200
Mohammedan minaret *picture* I 265
museums C 16 *See also in Index* Museums *table*
universities C 16 *picture* F 277
World War II meeting W 297 *picture* R 212
Cairo (*kēr ō*) Ill port and railroad center in s at junction of Mississippi and Ohio rivers pop 12 123 shipping point for farm produce flour lumber *maps* I 37 U 253
Mississippi levees to Gulf M 308
Caisson (*kā sŏn*) a type of artillery ammunition wagon
Caisson in building construction C 17 B 344 *picture* C 17
Caisson disease C 17 H 331
Caius Caesar *See in Index* Caligula
Cajalco (*kä hăl kō*) **Reservoir** C 39
Cajamarca (*kä hä mar kä*) Peru Inca city P 280 *maps* P 164 S 252
Cajans or **Cajuns**
Alabama A 118
Louisiana A 6
Cajetan (1470–1534) general of the Dominicans created cardinal 1517
Luther and L 353
Cajon Pass in California between San Gabriel and San Bernardino mountains gateway for overland travel to s California C 37
discovery C 47
Cake B 298
wedding M 101a
Calabash gourd G 144
Calabria (*ka lā bri a*) Italian *ka lā brē ä*) name formerly given to se Italy (the heel) now given to region in s w (the toe) area of present Calabria 58.. sq mi pop 2 042 690 I 268 *map* I 263
earthquake (1908) E 198
Caladium ornamental water plant with large arrowhead leaves stem structure W 66
Calais (*kă lā* also *kal ā*) France seaport on Strait of Dover pop 41 556 C 18 *maps* F 259 E 424–5
early cable C 7
Hundred Years War H 446
Rodin's Burghers of Calais S 70 R 178 *picture* R 177 *color picture* S 71
Calamine a mineral containing zinc silicate Z 351 M 266
Calamint a perennial herb (*Satureja alpina*) of the mint family Flowers tiny purple tubular in whorls of 4 to 6 leaves oval aromatic used in rock gardens also called a pine savory
Calamity Jane (1852?–1903) popular name of Martha Jane Canary Burke a woman of the frontier Birthplace not definitely known but probably near Princeton Mo Lived in many western army posts and mining camps spent much time in Deadwood (Black Hills of South Dakota) where she first came in 1876 Was a good rider and rifle shot From about 1878 to 1891 was a driver in a bull (ox) freight train from Fort Pierre to Sturgis S D Although a rough character many good deeds credited to her Buried in Deadwood beside Wild Bill Hickok Nickname may have originated from her threat that to offend her was to court calamity
Calamus a split reed pen P 114
Calamus or **sweet flag** an aromatic herb (*Acorus calamus*) of the arum family with thick creeping root stock swordlike leaves and yellowish green spathe root used as tonic and sometimes to flavor beverages
rootstock S 339
Calapooya (*ka la pọ ya*) a division of the Kalapooian Indian family which lived between the Willamette and Umpqua rivers in Oregon
Calash or **calèche** two or four wheeled carriage
Calavo (*kä lä vō*) trade name for avocado F 304
Calcareous materials compounds of calcium C 165
Calcasieu (*kal ka shū*) River rises in w central Louisiana and flows s 200 mi to Gulf of Mexico widens near mouth to form Lake Calcasieu *map* L 330
Calceolaria (*kal se ō lā ri a*) a genus of plants commonly called slipper wort *See in Index* Slipperwort
Calciferol vitamin D_2 V 496
Calcimine (*kal si min*) or **kalsomine** paint P 41
Calcio (*kal si ō*) medieval football game F 230
Calcite (*kăl sīt*) Mich in Presque Isle County large limestone and ore port on Lake Huron post office Rogers City (pop 3873) *map* G 181
Calcite crystallized mineral form of calcium carbonate ($CaCO_3$) C 18 M 262 *pictures* C 18 M 265
crystal *picture* C 525
Iceland spar C 18 I 10
polarizes light L 234
relative hardness M 261
Calcium (*kal si um*) a metallic chemical element C 18 *pictures* C 18 *tables* P 151 C 214
alkaline earth metal A 168
alloy cleanser A 174

Callière, Louis Hector de (1646–1703), French colonial official, born Cherbourg, France; 1684–99 governor of Montreal; 1699–1703 governor general of New France; known for his wise dealings with the Iroquois.

Callimachus (*kă-lim'a-kŭs*), Greek lyric poet of 3d century B.C.; credited with some 800 works.

Callimachus (5th century B.C.), Greek sculptor; credited with a group of dancing Laconian maidens and a gold lamp for the Erechtheum; said to be the originator of the Corinthian capital and the running drill for boring in marble.

Calliope (*kă-lī'ō-pē*), in Greek mythology, Muse of epic poetry M-454

Calliope, series of steam whistles arranged to give tunes when sounded by keyboard, *picture* C-311

Calliopsis. *See in Index* Coreopsis

Callippus, or Calippus (4th century B.C.), Greek astronomer, born Cyzicus, Asia Minor; instituted use of Callippic cycle, a period of 76 years (the equivalent of four Metonic cycles minus one day).

Callisto (*ka-lis'tō*), in Greek mythology, attendant of Artemis and mother of Arcas, because of love affair with Zeus she was turned into a bear by Hera, or Artemis; mistaken for an ordinary bear, was about to be slain when rescued by Zeus who placed her in the sky as the constellation, Great Bear

Callistus. *See in Index* Calixtus

Callot (*ka-lō*), **Jacques** (1592–1635), French engraver, master of art of design, skilled in putting many figures in small space

Calloway, Cabell (Cab) (born 1907), Negro composer bandleader, and actor born Rochester, N. Y.; in 'Porgy and Bess' 1952.

Calmar, Sweden *See in Index* Kalmar

Calms, belt of. *See in Index* Doldrums

Cal'omel, mercurous chloride M-174
fireworks, used in F-93

Caloosahatchee River, in s.w. Florida, 75 mi long; main outlet of Lake Okeechobee; forms western arm of Cross-State Canal.

Calor'ic, imaginary fluid once assumed to be heat H-320

Calorie (*kăl'ō-rĭ*), **or calory**
heat unit C-49, H-319, *table* E-344c:
latent heat of water W-63
measure of food value F-217, *chart* F-216, *table* E-344c

Calorim'eter, instrument for measuring quantity of heat
Bunsen inventions B-352

Caloso'ma beetle, *pictures* B-104

Calotype process, photography P-225–6

Cal'pé, in ancient geography, one of the Pillars of Hercules; modern Gibraltar
legendary origin H-342

Calpur'nia, wife of Julius Caesar whom she married in 59 B.C. C-14

Caltanissetta (*kăl-tä-nē-sĕt'tä*), city in Sicily; pop. 37,463; center of sulfur industry: *map* E-425

Calthrop, Samuel Robert (1829–1917), Unitarian minister, born Lincolnshire, England; came to U. S. 1853
streamlined train S-429

Cal'trop family, or Zygophyllaceae (*zī-gō-fĭ-lā'sē-ē*), family of plants, shrubs, and trees, including the lignumvitae and the creosote bush.

Cal'umet, Mich., town on Upper Peninsula, about 68 mi. n.w. of Marquette; pop. 1256; situated in Calumet township, center of great copper-mining district: *maps* M-226, U-253

Calumet, or ceremonial pipe, the "peace pipe," of North American Indians; tobacco pipe with stone bowl and long reed stem ornamented with eagles' feathers: *pictures* I-104b, 110c

Calumet and Hecla Mine, in Michigan C-473–4

Calumet City, Ill., city 16 mi. s.e. of Chicago; pop. 15,799; packing-house products, chemicals, pickles: *map, inset* I-36

Calusa, Indian tribe that formerly lived in Florida, *map* I-106f, *table* I-107

Cal'vary, or Golgotha, the place where Jesus was crucified J-340, J-336

Calvé (*kăl-vā'*), **Em**[illegible]58–1942), French operatic singer of great dramatic power: *picture* O-394

Cal'verley, Charles Stuart (1831–84), English humorous poet and barrister ('Fly Leaves'; 'Theocritus Translated into English Verse').

Calvert, Barons Baltimore. *See in Index* Baltimore

Calvert (*kăl'vẽrt*), **Leonard** (1606–1647), first colonial governor of Maryland, brother of Cecilius, 2d Lord Baltimore B-38
buys land from Indians M-110, *picture* M-109

Calvi (*kal'vē*), **battle of** (1794), named for small seaport in n.w. Corsica; naval battle between English and Corsicans in which Nelson lost his right eye.

Cal'vin, John (1509–64), French theologian and Protestant reformer C-49, C-302–3, *picture* R-92
French literature influenced by F-287
Geneva headquarters G-36
Knox influenced by K-63
Puritans influenced by P-443
Reformation, part in R-92, 93

Calvin College, at Grand Rapids, Mich.; founded 1876 by Christian Reformed church; arts and sciences.

Calvinists, followers of John Calvin's teachings
in Thirty Years' War T-118
witches, persecution of W-180

Calycan'thus, a genus of aromatic shrubs with opposite leaves and large brownish purple flowers; popularly called Carolina allspice. *Calycanthus floridus*, called the strawberry shrub because the crushed flowers yield the fragrance of strawberries, is a common garden shrub.

Calycanthus family, or Calycanthaceae (*kăl-i-kăn-thā'sē-ē*), a family of plants, native to North America and e. Asia, including Carolina allspice and the meratias.

Calydon (*kăl'ē-dŏn*), ancient city of Aetolia, Greece; scene of legendary hunt for the monstrous Calydonian boar which Artemis sent to ravage the country because she had been neglected in a sacrifice by the king of Calydon.

Calypso (*ka-lip'sō*), in Greek mythology, nymph who detained Odysseus for seven years O-344

Calypso music, folk music of the Negroes of Trinidad; became popular as form of jazz music in U. S. 1938; simple, characteristic melodies; words often about persons prominent in current events.

Calyx (*kā'līks*), sepal structure of flower F-184

Cam (*kăṅ*), **or Cão** (*kouṅ*), **Diogo,** Portuguese explorer of 15th century D-82

Cam, river in Cambridgeshire, England; 40 mi. long, emptying into Ouse.

Cam, in machinery, *picture* M-160b
automobile A-515, *diagram* A-515:
early use A-504

Camacho, Manuel Avila. *See in Index* Avila Camacho

Camagüey (*kä-mä-gwā'*), largest inland city of Cuba, in province of Camagüey, 170 mi. n.w. of Santiago de Cuba; pop. 204,254, with suburbs; cattle products: C-527, *maps* C-528, W-96

Camarasa Dam, in Spain, at junction of Noguera Pallaresa and Segre rivers. *See also in Index* Dam, *table*

Camargo (*kä-mär-gō'*), **Marie Anne de Cupis de** (1710–70), Belgian ballerina, born Brussels, Belgium, where she first appeared as a dancer; made Paris debut 1726; The Camargo Society (founded London 1930 to sponsor ballet) named for her: D-14h

Cambacérès (*kăṅ-bȧ-sā-rĕs'*), **Jean Jacques Régis de, duke of Parma** (1753–1824), French statesman; 2d consul under Napoleon; played part in compiling Code Napoléon.

Camber, in airplane A-88

Camberwell, England, metropolitan borough of s. London; pop. 179,729; Camberwell Green once celebrated for fairs.

Cam'bium, "growth layer" between bark and wood of trees B-55, P-292, *diagram* T-179

Cambo'dia, free state in s.w. Indo-China on lower Mekong River; about 52,500 sq. mi.; pop. 3,746,000; cap. Pnom-Penh: I-122–6, *maps* I-123, A-407
Angkor Vat I-125, *pictures* A-419, I-121
cleaning rice, *picture* I-122
flag F-136d, *color picture* F-134
relationships in continent, *maps* A-406–7, 411–12
royal grounds, *picture* I-126

Cambodia River, in s.e. Asia. *See in Index* Mekong River

Cambon (*kăṅ-bôṅ'*), **Jules** (1845–1935), French diplomat, brother of Pierre Cambon; governor general of Algeria; French ambassador to U. S. 1897–1902, to Spain 1902–7, to Germany 1907–14; deputy prime minister 1917 for the specific purpose of establishing a common Franco-American war policy.

Cambon, Pierre Paul (1843–1924), French diplomat; prefect departments of Aube, Doubs, Nord successively; minister Tunisia; ambassador to Spain 1886–90, to Turkey 1890–98, to England 1898–1920; instrumental in setting up the *entente cordiale*.

Cambrai (*kăṅ-brĕ'*), France, city 3[illegible] mi. s. of Lille; pop. 24,580; linen goods, especially cambric, to which it gave name: *maps* B-111, E-425
World War I battles W-227, 230

Cambrai, League of, alliance of Louis XII of France, Emperor Maximilian I, Ferdinand the Catholic of Spain, and Pope Julius II for partition of Venetian territories (1508) V-446, J-364

Cambrai, Peace of (1529). *See in Index* Treaties, *table*

Cam'bria, ancient name of Wales.

Cam'brian Mountains, highlands of Wales, *map* B-321

Cambrian period, in geology G-59, *diagrams* G-52, 58, *picture* P-406a, *table* G-57

Cambric (*kām'brĭk*), originally a fine linen fabric (from Cambrai, France, where probably first made); now usually a soft, closely woven cotton cloth; also a stiff lining fabric of cotton.

Cambric tea T-33

Cam'bridge, or Cambridgeshire, agricultural county in e. England; 492 sq. mi.; pop. 140,000; county seat Cambridge: *map* E-347

Campanile (*kăm-pa-nē'lē*, Italian *käm-pä-nē'lā*) B-118. *See also in Index* Bell tower

Campanini (*käm-pä-nē'nē*), **Cleofonte** (1860–1919), Italian musical director, manager of Chicago and Philadelphia opera companies.

Campan'ula, genus of herbs including the bluebell or bellflower and the harebell B-211, *color picture* F-174
how to plant, *table* G-16

Campanulaceae. *See in Index* Bellflower family

Campbell, Alexander (1788–1866), Irish-American theologian; founder with his father Thomas (1763–1854) of Disciples of Christ (Campbellites); also founder of Bethany College, W. Va.; prolific writer.

Campbell, Sir Alexander (1822–92), Canadian statesman; a leader in Confederation movement, first postmaster general of Dominion; leader of Conservative party for 20 years in senate.

Campbell, Sir Colin (Lord Clyde) (1792–1863), British general; served in Peninsular War, Crimean War, and Sepoy Mutiny
recaptures Lucknow L-339

Campbell, Sir Malcolm (1885–1949), British auto racer, aviator, broker; began auto racing as hobby in 1910; knighted 1931 ('My Thirty Years of Speed'; 'Romance of Motor Racing').

Campbell, Mrs. Patrick (Beatrice Stella Tanner) (1867–1940), English actress ('The Second Mrs. Tanqueray'; 'The Notorious Mrs. Ebbsmith'; 'Magda'; 'Pygmalion').

Campbell, Robert, or MacGregor, Robert (1671–1734), celebrated Scottish outlaw Rob Roy R-166

Campbell, Robert (1804–79), fur trader and businessman; born in County Tyrone, Ireland; came to America about 1824; joined Ashley's expedition to Rockies; soon led parties organized by the Sublettes and others; saved William Sublette's life in battle with Blackfeet at Pierre's Hole in 1832. He settled in St. Louis in 1835 and was active in public affairs, serving twice as Indian commissioner.

Campbell, Robert (1808–94), Canadian fur trader and explorer, born Glenlyon, Perthshire, Scotland; with Hudson's Bay Company 1832–71; explored Mackenzie River basin and the Yukon; 1848 discovered Upper Yukon River.

Campbell, Thomas (1777–1844), Scottish poet now best known for his stirring lyrics ('Hohenlinden'; 'Ye Mariners of England'; 'Lord Ullin's Daughter'; 'The Battle of the Baltic'); buried in Westminster Abbey.

Campbell, Thomas (1790–1858), English sculptor of classical school ('Pauline Bonaparte', 'Duke of Wellington').

Campbell, William (1745–81), soldier, born Augusta County, Va.; served with Patrick Henry's Virginia forces; in Virginia House of Delegates; brigadier general under Lafayette.

Campbell, William Edward March (1894–1954), pen name William March, writer, born Mobile, Ala. (novels: 'Company K', 'The Tallons', and 'The Bad Seed'; collected short stories: 'Trial Balance').

Campbell, William Wilfrid (1860–1919), Canadian poet; retired from Episcopal ministry for literary work ('Lake Lyrics'; 'Sagas of Vaster Britain').

Campbell, formerly **East Youngstown**, Ohio, industrial and residential city on Mahoning River, suburb of Youngstown; pop. 12,882; iron and steel manufactures: *map* O-356

Campbell-Bannerman, Sir Henry (1836–1908), British Liberal leader, born Glasgow; secretary for war 1886, 1892–95; premier 1905–8; noted for support of Irish home rule, liberal policy toward Boers, campaign against House of Lords.

Campbell Island, island s. of and belonging to New Zealand; area 44 sq. mi.; pop. 9: *map* W-205

Campbellites. *See in Index* Disciples of Christ

Campbellton, New Brunswick, town 145 mi. n. of Frederickton on Restigouche River in farming region; pop. 7754; fish, lumber, pulp, aerated waters, brick: *maps* C-69, 73

Campeachy wood (from Campeche, Mexico), logwood L-296

Campeche (*kăm-pē'chē*, Spanish *käm-pā'chā*), Mexico, state on w. side of Yucatán peninsula; 19,670 sq. mi.; pop. 122,087; cap. Campeche (pop. 31,274); chicle, logwood, livestock, henequen: Y-344, *maps* M-189, Y-345

Campeche, Mexico, capital of state of Campeche, on Gulf of Campeche; pop 31,274: Y-345, *maps* M-195, Y-345

Cam'perdown, Netherlands, village on North Sea 27 mi. n.w. of Amsterdam; British naval victory over Dutch (1797).

Camp Fire Girls C-54–5, *pictures* C-54–5

Camp fires, how to make C-60–2

Camphene L-89

Camphor (*kăm'fór*), an aromatic gumlike substance C-55
synthetic production C-55

Campi Flegrei ("burning fields"), Italy I-267

Campinas (*kăm-pē'nas*), Brazil, city in s.e., 60 mi. n.w. of São Paulo; coffee production and trade; pop. 101,746: *maps* B-288, S-253

Camping C-56–63, *pictures* C-56–63, *Reference-Outline* V-425
back-yard camping, *Reference-Outline* V-425
bedding outfit C-58
books about H-397
Boy Scout campers, *pictures* B-274, 277
Camp Fire Girls C-54
cellar, *picture* C-63
clothes C-57–8
cookery and mess kit C-58–9, C-463, *pictures* B-274, C-61–3
entertainment at camp, *picture* C-319b
equipment C-57–60: check list C-58; homemade C-59
fire building: choosing wood C-60–1; putting fire out C-62; types C-61–2
4-H camps F-252, 252a
Girl Scouts, *pictures* G-113, 114, C-63
heating the tent C-62
hiking rules C-63
hygiene C-62–3
leader C-56
National Music Camp B-46a
packing equipment C-58
planning the trip C-56
poisons, and insect pests, caution C-63
safety suggestions C-63
sanitation and drinking water C-62–3
site, selection C-56–7
tent C-59, *pictures* B-277, C-56–8, F-237, M-279, S-142, V-425
tools C-59–60
water hazards C-63

Cam'pion, Thomas (1567–1620), English poet and musician; composed words and music for many lyrics ('Four Books of Airs'; 'Observations in the Art of English Poesie').

Campion. *See in Index* Silene

Campion, rose. *See in Index* Mullein pink

Campoformido, formerly Campo Formio, Italy, village 60 mi. n.e. of Venice
treaty of Campo Formio (1797) N-8

Campos, the grassland region (or savanna) of central Brazil G-168b, S-275, *maps* S-255, G-169

Campo Santo (*käm'pō sän'tō*), name meaning "holy field" applied to burial grounds in Italy
Pisa I-278

Camp robber, popular name for the Canada jay.

Camp'us, college, *picture* C-384

Campus Martius (*mar'shŭs*), large field on Tiber River near ancient Rome, used for military drills and popular assemblies R-197

Cam Ranh Bay, Indo-China, on e. coast; port is city of Cam Ranh; fine harbor; naval base

Camus (*kȧ-mü*), **Albert** (born 1913), French writer, born near Bône, Algeria; moved to France 1940; active in French resistance movement (novels: 'The Stranger', 'The Plague'; play: 'Caligula'; philosophical essay: 'The Rebel').

Can, tin F-220–1

Cana (*kā'na*), of Galilee, a village in Palestine near Nazareth; scene of Christ's first miracle (John ii. 1-25) when water became wine at marriage feast: *map* B-138

Canaan (*kā'năn*), name of pre-Israelite Palestine, which was peopled by descendants of Canaan, son of Ham J-352, *map* B-138

Ca'naanites J-352
alphabet A-177, *chart* A-177
Phoenicians identified with P-205

Can'ada, a nation of North America; 3,845,774 sq. mi.; pop. 14,009,429; cap. Ottawa: C-64–94, *maps* C-67–9, 72–3, 80–1, 86, 250, P-346, *pictograph* C-66, *pictures* C-64–5, 70, 76–7, 83–5, 87–92, *Reference-Outline* C-93–4
agriculture C-84–6, *map* N-257: government aid C-86; irrigation I-253; maple sugar and syrup M-83; wheat C-85, W-115, 116, *map* W-117, *pictures* A-143, C-70, W-116
air transport C-76, 84
animals C-78, 87, *map* N-258
area, other countries compared C-65, *chart* U-246
armorial bearings F-136a, *color picture* F-131
art C-90–1
banks and banking B-52, 48, 51
bibliography C-94
boundary unfortified U-377, G-184, C-89
cable connections C-5, 8
canals C-77, C-109, S-19, *maps* C-72–3, S-20: Lachine Canal, *picture* C-107; Rideau Canal C-109, O-428, 429, *picture* O-428; Sault Sainte Marie S-49–51; Trent C-109, H-452; Welland Ship Canal W-90
cities, *list* C-65. *See also in Index* names of cities
citizenship C-83, C-319
climate C-77–8, A-327–8, N-248, 253, P-103: animal and plant life varies with, *map* N-258
coast lighting L-238
commerce C-89: exports and imports. *See in Index* Trade, *table*
education C-90: illiteracy P-374
fisheries C-86–7, *picture* C-70: government hatcheries F-109; lobster L-287
flags F-136a, *color picture* F-131: historic F-136a, *color picture* F-131
forests and lumbering C-78, 87, F-239b, L-340, *picture* C-89: Brit-

FACTS ABOUT SOME OF THE GREAT SHIP AND BARGE CANALS OF THE WORLD

Name	Country or State	Length Miles	Depth Feet	Width Feet	Year Opened
Albert	Belgium	79	16.5	116	1939
Baltic-White Sea (Stalin)	Russia	141	..	...	1933
Beaumont-Port Arthur (Sabine-Neches)	Texas	40	32	200	1916
Cape Cod	Massachusetts	13.5	32	540	1914, 1941
Chesapeake and Delaware	Delaware-Maryland	19	27	250–400	1829, 1934
Chicago Sanitary & Ship	Illinois	30	22	160	1900
Corinth	Greece	4	26	72	1893
Erie*	New York	340	12	45	1825, 1918
Göta	Sweden	240	.	...	1832
Houston Ship Channel	Texas	50	34	200–400	1914
Juliana	Netherlands	21	11.8	52.5	1935
Kiel	Germany	52.8	37	144	1895
Manchester	England	35.5	28	125	1894
Moscow-Volga	Russia	79	18	100	1937
Panama	Canal Zone	50.7	41	110	1914
Rhone-Marseilles	France	50.3	10.7	52	1927
Rhone-Rhine	France	197	6.9	17.2	1833
St. Lawrence River Canals	Canada	46	14	45	1825, 1899
Sault Ste. Marie	Canada	1.3	18.25	60	1895
Sault Ste. Marie	Michigan	1.6	25	100	1855, 1919
Suez	Egypt	106†	36	147	1869
Welland Ship	Canada	27.6	30	80	1932

*Main branch of the New York State Barge Canal.
†Includes channel approaches.

Candlefish or **eulakan** (*ū lā kăn*) a very oily smeltlike fish of n w coast of America used by Indians as candle by stringing through it the pith of a rush or a strip of bark as wick also used as food

Candle flower *See in Index* Ocotillo

Candlemas church festival February 2 commemorates presentation of Christ in Temple F 56 G 219

Candle mold of American colonists *picture* A 203

Candlenut. *See in Index* Candleberry tree

Candle pins a form of bowling B 266

Candle power light given by a specified type of candle used as unit of illuminating power L-228

Candlestick L-90 *picture* L 445
colonial lamp made from, *picture* I 185

Candle tree tropical tree (*Parmentiera cerifera*) of bignonia family native to Panama Trunk short, usually spiny, leaves in groups of 3 oval flowers white to 3 in long funnel form Fruit smooth, whitish yellow to 4 ft long hangs from the branches like candles

Candolle (*kăn dōl*) **Augustin de** (1778 1841) Swiss botanist introduced natural as opposed to artificial, or Linnaean, system of classification

Candour Mrs. in Richard Brinsley Sheridan's School for Scandal a slanderer who affects great frankness

Candy C 110–12 *pictures* C 110–12
banana figs B 46
chocolate C 112 C 288 289
glucose in C 111 112
licorice L 221
pure food laws C 112

Candytuft a genus (*Iberis*) of annual and perennial plants of the mustard family usually low growing with clusters of small white through purple flowers
how to plant, *table* G 16

Cane name applied to various plants having long reedlike stems including the sugar cane and bamboo also applied to all walking sticks because of wide use of cane in making them

Canea Crete *See in Index* Khania

Canebrake thicket of canes G-166

Cane fishing pole F-118a, *picture* F 118a

Cane palm *See in Index* Rattan palm

Cane sugar S 444 446 *picture* S 444
See also in Index Sugar Sugar cane

Canes Venatici (*kā nēz vē-năt i sī*) a northern constellation *chart* S 376

Canfield Dorothy (Mrs John R Fisher) (born 1879) author born Lawrence Kan popular for novels concerned with problems of home and children ('Understood Betsy' book for girls 'The Bent Twig' 'The Brimming Cup' 'The Deepening Stream' 'Seasoned Timber' novels 'Our Young Folks' study of postwar youth problems 'Four square' short stories)

Canidae (*kăn i dē*) the dog family D-120

Canine teeth dog teeth or cuspid teeth T 34

Canis (*kā nis*) the dog genus includes jackal wolf and fox

Canisius (*kā-nish i us*) **Petrus** (1521–97) Dutch Jesuit theologian and missionary drew up catechism of Roman Catholic faith active in Counter Reformation

Canisius College at Buffalo N Y Roman Catholic for men evening sessions coeducational founded 1870 arts and sciences graduate studies

Canis Major (Great Dog) a constellation containing Sirius the brightest star C 457 *charts* S 373 379 381

Canis Minor (Little Dog) a constellation *charts* S 373 379 381

Canister an old type of artillery projectile A 400

Canker a plant disease which attacks various kinds of trees and causes abnormal growths or decay

Cankerworm often called inch worm or measuring worm caterpillar destructive to trees C 112 *color picture* B 368

Canna (*kăn ȧ*) plant C 112 13 *picture* C 113

Cannabis genus of hemp plants H 333

Cannae (*kăn ē*) ancient village near s e coast of Italy
battle (216 B C) H 260

Cannan Gilbert (born 1884) English novelist and dramatist, born Manchester translated Rolland's 'Jean Christophe' apostle of revolt against conventions ('Round the Corner' 'Young Earnest' 'and Time and Eternity' novels 'The Release of the Soul' play)

Canned heat alcohol solidified with stearic acid A 146

Cannel coal (candle) a bituminous noncoking type burning with a bright candlelike flame splits into layers and burns well in open grates C 367 W 100

Cannes (*kăn*) France seaport and fashionable winter resort on Mediterranean 18 mi s w of Nice pop 86 647 *maps* I 262 E 4°5

Cannibal Islands name once given to the Fiji Islands F 65–6 *picture* F 66

Cannibalism practice of eating human flesh by human beings
Africa A 236b
Aztecs A 544
Fiji Islands F 66
Melanesians P 4
New Guinea N 141 142

Canning George (1770–1827) brilliant British statesman and orator as foreign secretary supported liberal tendencies recognized independence of revolted Spanish colonies in South America

Canning of foods F 219–22
cold pack method F 222
distribution of canned goods *diagram* E 228
factory processes F 219 20 *pictures* F 219 220 U 304
fish salmon B 315 tuna T 205
home canning F 221 2 *picture* F 221
standardization F 221
tin cans why used T 137
United States F 221 California C 42
vacuum packing F 221
waste utilized fish F 55

Cannizzaro (*kän-nēd dzä ro*) **Stanislao** (1826–1910) Italian chemist, born Palermo discovered cyanamide and benzyl alcohol defined difference between atomic and molecular weights established Avogadro's law in chemical science

Cannon Annie Jump (1863–1941) astronomer born Dover Del associated with Harvard Observatory after 1897 discovered 300 variable stars 5 new stars 1 spectroscopic binary compiled bibliography of variable stars and catalog of 225 000 stellar spectra

Cannon Cornelia James (born 1876) author born St Paul Minn Cannon Mt in Glacier National Park named for her first woman to gain summit contributor to magazines on social and economic subjects western travels gave insight into pueblo life ('Pueblo Girl' 'Red Rust' 'Lazaro in the Pueblos')

Cannon Joseph Gurney (1836–1926) political leader born Guilford N C Republican member of Congress from Illinois 1873–91 1893 1913 1915–23 speaker of House of Representatives 1903–11
powers as speaker restricted T 4

Cannon A 397–400 *pictures* A 397 400 *See also in Index* Artillery

Cannon of horse *picture* H 428a

Cannon lifesaving Lyle gun L-225 *pictures* L-226

Cannon Ball River N D rises in s w and flows e 150 mi to Missouri River *maps* N 282, 288

Cannon ball tree a tree (*Couroupita guianensis*) bearing large spherical woody shelled fruit native to tropical South America timber source

Cano (*kä no*) **Alonso** (1601 67) Spanish architect painter and sculptor chief architect of Granada cathedral religious paintings characterized by bold design and pure flesh tints sculptures vigorous and skillful for variety of his talents dubbed Spanish Michelangelo

Cano Juan Sebastián del (*hwan sa-bast yän del*) (1460? 1526) Spanish navigator commanded one of Magellan's vessels on his famous expedition after Magellan's death (1521) took command of expedition and completed first circumnavigation of the globe (1522) began another voyage (1525) by Magellan's route died while crossing Pacific *map* M 33

Canoe birch or **paper birch** B 155 *picture* C 113 *table* W 186c

Canoes and canoeing C 113–14 B 214 *pictures* B 218 C 113–14 *See also in Index* Boat
beaching canoes *picture* C 59
birchbark canoes B 214 C 114 B 155 *picture* C 113 making *pictures* C 113 I 102
boats distinguished from B 214
dugout canoes C 114 Indian *picture* I 106d Mexico *picture* M 207
New Guinea war canoes N 142
managing C 113–14 *picture* C 114
outrigger B 219 *pictures* B 218 P 13
Pacific Islands *pictures* P 13 B 218
sailing canoes C 113 114
sponson type C 113

Canoewood name for tulip tree T 204

Canon an ecclesiastic in the Church of England or the Roman Catholic church C 302

Canon inspired books of Bible B 136

Canon or "round" in music M 460 music Sumer is icumen in M 460 music M 459

Canon City Colo health resort 41 mi n w of Pueblo on Arkansas River pop 6345 coal mining cattle raising fruit growing and truck gardening at entrance to Royal Gorge famous for scenic splendor state penitentiary *map* C 409

Canonical hours M 355 356

Canonicus (died 1647) American Indian chief granted Roger Williams land for settlement in Rhode Island hero of John Lathrop's poem 'Speech of Canonicus'

Canonization elaborate ceremony in Roman Catholic church at which a deceased person is formally declared by the pope to be a saint It is preceded by (1) declaration that the person is venerable (2) lengthy inquiry into sanctity and proof of miracles performed result ing in beatification (3) another long period during which proof of performance of two miracles since

satirical and expressionistic dramas and short stories ("The Fiddler FLP "The World We Live In" with his brother Josef "War with the Newts")

Cape leather and gloves G 126

Capella Martianus (A D 5th century) Latin writer of n Africa wrote Satyricon encyclopedia greatly used in Middle Ages his statement of heliocentric system may have influenced astronomer Copernicus

Capella a fixed star third brightest visible in northern hemisphere *charts* S 373 376 379–80

Cape marigold See in *Index* Dimorphotheca

Cape May N J, resort at s end of state pop 3607 N 156 *map* N 16

Cape of Good Hope or **Cape Province** formerly **Cape Colony** largest province of the Union of South Africa 277 113 sq mi pop 4 4 C 118 *maps* S 242 A 47, 42
Capetown capital C 118–19 *picture* C 119
climate S 242
education S 243
history S 243–4 245
products S 243
zebra Z 350

Cape of Good Hope promontory near southern tip of Africa C 118 D 83 *maps* S 242 A 47, *picture* A 34

Cape primrose or **Streptocarpus** a genus of perennial plants of the Gesneria family native to Africa Flowers purple or blue tubular in loose clusters rising in some species directly from the base of one large hairy leaf (S dunnii) in other species from a cluster of soft wavy edged leaves similar in appearance to English primrose

Cape Province See in *Index* Cape of Good Hope

Caper a genus of plants (*Capparis*) the spiny shrub (*Capparis spinosa*) has short lived white flowers flower buds used to make pickles used as a condiment S 340

Capercaillie or **capercailzie** (*kap ẽr kāl yi*) a large European game bird (*Tetrao urogallus*) of the grouse family also called mountain cock or cock of the woods

Capernaum (*ka pẽr na um*) ancient town in Palestine often visited by Jesus location long disputed but now generally considered to have been at site of ruins of Tell Hum on n coast of Sea of Galilee *map* B 138

Cape stock annual plant of genus *Heliophila* of mustard family native to South Africa Flowers small blue with white eye in long clusters stem hairy some are perennial with yellow white or lilac flowers

Capet (*ka-pĕ* also *ka pēt* or *kăp ĕt*) House of reigning family of France from 987 to 1328 began with Hugh Capet ended with Charles IV F 268 F 432 *See also in Index* France *table* of rulers

Capet Hugh (939?–996) king of France 987–996 elected by nobles and prelates to succeed Louis V last of the Carolingians founded Capetian line F 268

Capetown capital of Cape of Good Hope province legislative capital of Union of South Africa pop 512 822 with suburbs C 118–19 *maps* A 47 S 242 *pictures* C 119 A 34 S 245

Capetown University of near Capetown Union of South Africa *picture* S 244

Cape Verde (*vẽrd*) **Islands** overseas province of Portugal in Atlantic 370 mi w of Cape Verde Africa 1557 sq mi pop 147 328 C 119, *map inset* A 47
Henry the Navigator inspires discovery H 340

Cape York Peninsula n Queensland Australia *maps* A 489 478 I 18

Cap Haitien (*kăp hā shĕn* French *kap a ē sē-ăṅ*) (locally **Le Cap**) seaport on n coast of Haiti West Indies 90 mi n of Port au Prince called Little Paris before earthquake of 1842 exports coffee logwood cacao honey sisal hemp pop 24 957 *maps* N 251 W 96

Capillarity C 119
liquids L 265 *diagrams* L 264
soil S 228

Capillary minute blood vessel connecting veins and arteries of the body B 208 209 H 311 314 L 351 *color picture* H 314

Capillary action L 264 C 119

Capistrano swallows See in *Index* San Juan Capistrano

Capital by Karl Marx M 105

Capital in architecture A 306 *pictures* A 308 *See also in Index* Architecture *table* of terms

Capital in economics F 222 223
banks B 47 48 9
bond *See in Index* Bond
capitalist class rise of during Industrial Revolution E 369c I 133
credit *See in Index* Credit
fascist doctrine of private ownership F 44
interest *See in Index* Interest
investments risks in F 227
Marxian doctrine C 426 M 105 S 216
obtained by sale of stock S 398
origin of word C 141
return from F 226
stock *See in Index* Stock
venture capital I 146

Capital and labor I 133–4 *See also in Index* Labor *subhead* capital and

Capitalism
enterprise system I 138
Marx's views M 105 C 426 S 216
rise during Industrial Revolution I 133

Capital punishment P 415

Capitals of the alphabet A 179
Latin manuscript forms B 232 235

Capital University at Columbus Ohio Lutheran founded 1850 arts and sciences education music nursing theology

Capitol United States W 27 8 *map* W 30 *pictures* W 29 31 33 U 356
design reflects St Peter's of Rome *picture* A 316
Federal Hall first capitol *picture* U 372
House of Representatives *pictures* U 356 357
Senate *picture* U 358
Statuary Hall S 239 W 28

Capitoline (*kap i tō līn*) **Hill** smallest but most famous of 7 hills of Rome site of famous temple of Jupiter R 194

Capitoline Museum Rome Italy *See in Index* Museums, *table*

Capitol Reef National Monument in Utah N 31 *map* N 18

Capitulation a form of treaty I 189

Capitulations treaties with Turkey T 220a

Capo di Monte porcelain factory in Italy P 398

Capon Springs W Va W 100 *map* W 107

Caporetto battle of W 227–8

Capote (*ka pō tē*) **Truman** (born 1924) writer born New Orleans La (novels The Grass Harp dramatized and Other Voices Other Rooms short stories Tree of Night also author of travel essays)

Capp Al real name Alfred Gerald Caplin (born 1909) cartoonist born New Haven Conn creator of Li'l Abner comic strip comic strip for *Infantry Journal* and Treasury Dept World War II lost a leg in childhood known for helping veteran amputees (Life and Times of the Shmoo)

Cappadocia (*kap a dō shi a*) ancient inland country in Asia Minor w of Euphrates River conquered by Persians and by Alexander the Great reduced to Roman province by Tiberius A D 17 later passed into Turkish hands *map* P 156
hospital H 429f

Cappel or **Kappel** Switzerland village in canton of Zurich
Zwingli slain in battle Z 366

Capelin Memorial Bridge Minneapolis Minn *picture* B 312

Capper Arthur (1865–1951) editor publisher and political leader born Garnett Kan publisher of many daily and weekly farm news and household papers governor of Kansas 1915 19 U S senator 1919–48 active in interests of farmer

Capra (*kā pra*) the goat genus G 128
includes ibex I 2

Capreol Frederick Chase (1803 86) Canadian merchant and financier born Hertfordshire England came to Canada 1829 promoted the Northern Ry and a ship canal between Lakes Huron and Ontario

Caprera (*ka prā ra*) Italian island near ne coast of Sardinia about 4 mi long Giuseppe Garibaldi died there in 1882

Capri (*ka prē*) island s of Bay of Naples Italy 5½ sq mi resort of artists N 4 *picture* I 270

Capricorn Tropic of *diagram* A 433 *map* E 16 17

Capricornus or **Goat** a constellation Z 352 *chart* S 378 A 434 *picture* Z 352

Caprification of figs F 64 65 *color picture* I 312

Caprifig a wild fig F 64 65

Caprifoliaceae See in *Index* Honeysuckle family

Caprimulgidae (*kăp ri mul gi dē*) a family of birds also goatsuckers including nighthawks and whippoorwills

Caprimulgiformes (*kap-ri mul gi-fôr-mē*) order of large winged weak footed birds comprising night hawks goatsuckers whippoorwills

Caprivi (*ka-prē vē*) **Count Georg Leo von** (1831 99) German soldier and statesman successor of Bismarck chancellor 1890–94

Cap rock fall *diagram* E 182

Capsicum a genus of peppers P 143

Capstan See in *Index* Nautical terms *table*

Captain
U S Air Force *table* A 384 insignia *picture* U 238
U S Army *tables* A 380 384 insignia *picture* U 238
U S Marine Corps *table* A 384
U S Navy N 89 *tables* N 89 A 384 insignia *picture* U 237

Captains Courageous novel by Rudyard Kipling K 50

Captive mine coal mine owned by a railroad steel manufacturer power company or other organization that consumes the mine's output

Capua (*kăp u a* Italian *kä pwa*) Italy town 17 mi n of Naples on site of ancient Casilinum (*kăs i li num*) pop 10 218 ancient Capua 3 mi distant was luxurious city under Romans
Spartacus at S 330

after removal from body: during World War I with H. D. Dakin devised Carrel-Dakin antiseptic treatment of wounds, using the so-called "Dakin solution," a solution of sodium hypochlorite and salt; member Rockefeller Institute for Medical Research 1912–39, member emeritus after 1939 ('The Culture of Organs'; 'Man the Unknown'; 'Reflections on Life')
work with Lindbergh L-253

Carreño (*kär-rān'yō*), **Teresa** (1853–1917), Venezuelan pianist; great technical virtuosity insight, and nobility of interpretation; recognized as leading woman pianist of her day; in addition, sang in opera and composed, chiefly for piano

Carrère (*kä-rėr'*), **John Merven** (1858–1911) American architect, born Rio de Janeiro, Brazil; in partnership with Thomas Hastings designed notable buildings, including the New York City Public Library and Senate Offices, Washington D C.

Carriages. *See in Index* Wagons

Carrick, seaman's knot used to join two hawsers.

Carrickfer'gus, historic Irish seaport in Northern Ireland 9 mi n e of Belfast, pop 8650; 12th-century castle *map* B-325

Carrickmacross (*kär'ik-ma-krôs'*), or **cutwork lace**, *picture* L-79

Carrier, Willis Haviland (1876–1950), mechanical engineer, born Angola, N Y., head of Carrier Corporation, developed the theory and techniques of modern air conditioning

Carrier, common. *See in Index* Common carrier

Carrier current, in telegraphy T-39

Carrier pigeon P-254

Carriers, of disease D-102. *See also in Index* Disease, *subhead* carriers

Carrier wave, in radio R-36
in frequency modulation R-45
television T-54a

Carrion beetle B-106, 108

Carroll (*kăr'ol*) **Charles, of Carrollton** (1737–1832) patriot, born Annapolis, Md ; member of Continental Congress; drafted Maryland constitution, U. S. congressman and senator; last surviving signer of Declaration of Independence. *See also in Index* Statuary Hall (Maryland), *table*
Homewood House, *picture* B-41
signature reproduced D-37

Carroll, Daniel (1730–96), Revolutionary War statesman, born Maryland: delegate to Continental Congress (1781), Constitutional Convention (1787); signed United States Constitution; first senator from Maryland: commissioner of District of Columbia (1791–95).

Carroll, Gladys Hasty (born 1904), novelist, born Rochester, N. H. (novels of life in Maine: 'As the Earth Turns' and 'West of the Hill'; 'Christmas without Johnny').

Carroll, James (1854–1907), American physician, born England; served in U. S. Army Medical Corps from 1898; member of yellow-fever commission in Cuba: M-403

Carroll, John (1735–1815), Roman Catholic prelate, born Maryland; Jesuit and professor theology, Bruges; returned to America; took prominent part in gaining recognition at Rome for American church; secured authorization for a Catholic seminary (Georgetown University); chosen first American bishop 1788; archbishop 1811.

Carroll, John (born 1892), painter, born Wichita, Kan.; first noted for sensitive landscapes; later paintings airy and sensuous, chiefly fragile, wispy girls in vaporous and luminous color.

Carroll, Lewis (1832–98), pen name of Charles L. Dodgson, English mathematician and story writer C-127–8. *See also in Index* 'Alice's Adventures in Wonderland'
letter facsimile L-171

Carroll, Paul Vincent (born 1900), Irish dramatist, born Ireland; schoolmaster in Scotland, his adopted country, early plays produced by Abbey Theatre in Dublin; success achieved 1938 in U.S. with 'Shadow and Substance'; plays deal with conflicts in Irish society ('The White Steed'; 'Kindred').

Carroll College, at Helena, Mont.; Roman Catholic institution; founded 1910; arts and sciences, nursing.

Carroll College, at Waukesha, Wis.; founded 1840 as Prairieville Academy, reorganized as Carroll College 1846, academic, collegiate, music departments

Carromata (*kär-rō-mä'tä*), public carriage in Philippines, *picture* P-199

Carrot C-128
digging machine, *picture* P-142a
drying at home, *picture* F-223
ornamental plant from, *picture* P-300
when and how to plant, *table* G-19
wild C-128, Q-11, *pictures* F-181, Q-11, *color picture* F-179

Carrousel. *See in Index* Merry-go-round

Carr Trophy, awarded each year to most valuable player in National Professional Football League. Originated 1938 to honor **Joseph (Joe) F. Carr** (1881–1939), a founder and first president of league.

Carrying, in falconry F-15

"Carrying coals to Newcastle" N-138b

Carson, Christopher (Kit) (1809–68), famous American guide and trapper C-128–128b, *pictures* C-128a–b, F-39
in Utah U-409

Carson, Edward Henry, Baron (1854–1935), Irish Unionist leader; head of Ulster rebellion against British government's Home Rule Bill for Ireland 1912–13; British attorney general, June–October 1915, in Asquith coalition cabinet; First Lord of the Admiralty 1916–17; member war cabinet 1917–18; opposed movement for Irish Republic.

Carson, Rachel L(ouise) (born 1907), marine biologist and writer, born Springdale, Pa.; member of zoology staff University of Maryland 1931–36; joined U.S. Bureau of Fisheries (now U.S. Fish and Wildlife Service) in 1936, editor in chief 1947–52 ('Under the Sea-Wind; a Naturalist's Picture of Ocean Life' and 'The Sea Around Us').

Carson City, Nev., state capital, in e., near California border: pop. 3082: C-129, *maps* N-132, U-252
Capitol, State, *picture* N-125

Carson Lake, small body of water in w. Nevada with no outlet; receives main stream of Carson River: N-124, *maps* N-126, 132

Carson-Newman College, at Jefferson City, Tenn.; Baptist institution, founded 1851; liberal arts.

Cart. *See in Index* Wagons

Cartagena (*kär-tä-gē'nä*, Spanish *kär-tä-hä'nä*), Colombia, seaport on Caribbean Sea; pop. 125,600; exports petroleum, coffee, alligator skins, cattle, hides, woods, tobacco: C-388, *maps* C-387, S-252, *pictures* C-389

Cartagena, Spain, seaport, manufacturing city, and mining center in s e. on Mediterranean; pop. 113,160, with suburbs; naval station; founded 3d century B.C. by Carthaginians; *map* S-312

Carte blanche, in law. *See in Index* Law, *table* of legal terms

Car'tel, in Europe a form of trust, called in U.S. a "pool" M-360

Carter, Helène, artist and illustrator of children's books, born Toronto, Canada; studied art in Toronto and New York City; illustrated R. L. Ditmars' 'Book of Prehistoric Animals' and 'Book of Zoography' and J. M. Lucas' 'Fruits of the Earth' and 'Earth Changes'.

Carter, Henry Rose (1852–1925), sanitarian and epidemiologist, born Caroline Co., Va.; noted for system of maritime quarantine; important work in world campaign against yellow fever.

Carter, Howard (1873–1939), English Egyptologist, born Norfolk, England; inspector general of antiquities for Egyptian government; with Lord Carnarvon (1922) discovered Tutankhamen's tomb: A-297, *picture* A-298

Carter, Mrs. Leslie (1862–1937), emotional actress, born Lexington, Ky.; sensational success, 1895, in 'The Heart of Maryland'; other successes include 'Zaza'; 'Du Barry'; 'The Second Mrs. Tanqueray'.

Carter, Lincoln J. (1865–1926), playwright, theatrical producer, born Rochester, N. Y. ('Remember the Maine'; 'The Flaming Arrow'; 'An American Ace').

Carter, Phyllis Ann. *See in Index* Eberle, Irmengarde

Carter, Russell Gordon (born 1892), author, born Trenton, N. J.; editorial staff *Youth's Companion* (1919–25); historical and adventure stories ('Three Points of Honor'; 'The White Plume of Navarre'; 'Shaggy—The Horse from Wyoming').

Carteret (*kär'tėr-ĕt*), **Sir George** (1610?–80), English royalist; lieutenant governor of Jersey, Channel Islands (1643–51): N-167
Radisson and Groseilliers sponsored by F-322

Carteret, John, Earl Granville. *See in Index* Granville, John Carteret

Carteret, Philip (died 1796), English rear admiral and explorer; voyaged round the world (1766–69); discovered Pitcairn Island and rediscovered Santa Cruz Islands; journal of voyage published in Hawkesworth's 'Voyages' (1773).

Carteret, N. J., borough 6 mi. s. of Elizabeth; pop. 13,030; steel and iron products, fertilizers, chemicals: *map* N-164

Cartesian co-ordinates, in geometry G-65

Carte'sianism, the philosophy of Descartes P-204
Voltaire derides V-523

Carthage (*kär'thiĝ*), ancient city and state in n. Africa C-129, T-207
colonizes Spain S-320
Hannibal H-259–60
Punic Wars R-185–6. *See also in Index* Siege, *table*
U. S. national cemetery at site N-166
Vandal capital V-437–8

Carthage, Mo., in farming, zinc- and lead-mining, and marble-quarrying region in s.w. on Spring River; pop. 11,188; bedsprings, explosives, shoes, overalls; destroyed during Civil War and rebuilt: *map* M-318

Carthage College, at Carthage, Ill.; Lutheran; founded 1870; arts and sciences, music.

Carthamin. *See in Index* Safflower

Carthu'sian Monks M-355, *picture* M-356
book plate B-247

Case'ment, Sir Roger (1864–1916), Sinn Fein leader; knighted (1911) for investigations of Putumayo rubber atrocities; active in Irish "Easter Rebellion" (1916): I-230b

Casement, window *See in Index* Architecture, *table* of terms

'Casey Jones', title of song based on adventures and death in a collision of **John Luther Jones** (1864–1900), locomotive engineer; he was born in Hickman, Ky., but learned railroading in Cayce (pronounced *kā'sē*), Ky.: L-98b

Casgrain (*kaz-grăn'*), **Henri Raymond** (1831–1904), Canadian biographer and historian; was ordained a priest and is known as Abbé Casgrain; wrote, in French, historical studies of French Canada.

Casgrain, Philippe B. (1826–1917), Canadian lawyer historian; brother of H. R. Casgrain in Parliament a Liberal; wrote on French-Canadian historical subjects

Casgrain, Thomas Chase (1852–1916), Canadian lawyer and statesman, nephew of H. R. Casgrain, born Detroit Mich., member of Parliament; postmaster general.

Cash, a Chinese copper coin usually has square hole punched in center for stringing; historical value about one-twentieth of a U. S. cent; name also given to other small coins in East: C-273

Cash account, how to keep B-229–30

Cashew (*kă-shō'*) a species (*Anacardium occidentale*) of tropical tree with rose-tinted clusters of fragrant flowers, seed kernel is an edible nut and source of oil, fleshy receptacle of seed is a fruit and source of a beverage; milky juice of tree is a gum used as basis of a varnish: F-304, N-316–17

Cashew family, or **Anacardiaceae** (*ăn-ă-kär-di-ā'sē-ē*) a family of trees and shrubs including the sumac, varnish tree, smoke tree, kafir plum, mango, pistachio pepper tree and poison ivy: P-340

Cashier's check B-48

Cashmere (*kăsh'mēr*), formerly name of present Kashmir, state n. of Indian peninsula; gave name to several products derived from there, such as Cashmere cloth, shawls, rugs. *See also in Index* Kashmir

Cashmere cloth, sometimes **kashmir** C-131

Cashmere goat G-129, *picture* C-356

Cashmere rugs, or **Kashmir rugs** R-247

Cashmere shawls G-129, K-18

Cash register C-131, *picture* C-131
 Dayton factory D-25

Casilinum, Italy. *See in Index* Capua

Casimir (*kăs'i-mēr*), name of several princes and kings of Poland, most important of whom were **Casimir III**, called "The Great" (1310–70), who added Little Russia and Red Russia to Poland and founded University of Cracow, and **Casimir IV** (1427–92), a great statesman who added West Prussia to Poland and instituted a high cultural period.

Casimir-Périer (*kă-zē-mēr' pār-yā'*), **J. P. P.** (1847–1907), fifth president of the Third Republic of France (June 1894–January 1895); resigned because of factional bickering and limitations on presidential power.

Casino (*kă-sē'nō*), at Monte Carlo M-378

Casiquiare (*käs-ē-kē-ä'rä*) **River**, navigable stream in s.w. Venezuela; connects Orinoco and Negro rivers, length 240 mi.: *map* V-442

Casket Letters M-106

Caskoden, Edwin. *See in Index* Major, Charles

Caslon, William (1692–1766), first of a famous family of English type founders; name is given to type faces still much used
 type T-230, *picture* B-235

Casper, Wyo., town on North Platte River on site of old Fort Casper; pop. 23,673; wool and oil center; railroad shops; Casper Junior College: W-326, *maps* W-323, U-252, *picture* W-325

Cas'pian Sea, salt sea on borders of Europe and Asia; 760 mi. long, 130 to 270 mi. wide: C-132, *maps* A-406, 411, E-419. *See also in Index* Ocean, *table*
 shore line and level C-132, D-152
 size, comparative. *See in Index* Lakes, *table*

Caspian suslik, or **peschanik**, animal. *See in Index* Suslik

Cass, Lewis (1782–1866), statesman, born Exeter, N. H.; governor of Michigan territory 1813–31; secretary of war 1831–36; U. S. senator 1845–48 and 1849–57; secretary of state 1857. *See also in Index* Statuary Hall (Michigan), *table*
 candidate for president T-28
 relations with Indians M-229

Cassaba melon. *See in Index* Casaba melon

Cassady, John H(oward) (born 1896), U. S. Navy officer, born Spencer, Ind.; commander of 6th fleet 1952–54; became 4-star admiral 1954; commander in chief of U. S. naval forces in e Atlantic and Mediterranean after 1954

Cassandra (*kă-săn'dra*), daughter of Priam, king of Troy; prophetess of woe, doomed never to be believed; in vain warned against keeping Helen and admitting the wooden horse; Agamemnon's captive; slain with him by Clytemnestra.

Cassano (*käs-sä'nō*), Italy, town 16 mi. e. of Milan; French defeated Imperialists 1705; Russians and Austrians defeated French 1799.

Cas'sareep, a condiment T-14

Cassatt', Mary (1855–1926), painter and etcher, born in Pittsburgh, lived in Paris; impressionist; favorite subjects, mothers and children.

Cassava (*kă-sä'va*), or **manioc**, plant from which tapioca is obtained T-14
 natives use S-262, *pictures* A-185, S-250
 starch from S-382

Cassegrain'ian telescope, *picture* T-49

Cassel (*käs'ĕl*), or **Kassel**, Germany, city on Fulda River 90 mi. n.e. of Frankfort-on-the-Main; pop. 162,132; manufacturing center; *maps* G-88, E-424

Cassena. *See in Index* Yaupon

Cassia (*kăsh'i-a*), a genus of the pea, or pulse, family; many species, most of them native to warm regions, include trees, shrubs, and wild flowers such as senna; most of them with showy clusters of golden or orange-yellow blossoms resembling the sweet pea in form, and with long beanlike seed pods and compound leaves of 6 to 20 leaflets
 cassia bark, or chinese cinnamon S-339, 340

Cassian (*kăsh'an*) **Way**, ancient military road from Rome to Arretium, Florence, and Lucca.

Cassidy, Hopalong. *See in Index* Boyd, William

Cassimere (*kăs'ē-mēr*), a plain woven or twilled wool fabric; has soft finish but no nap; used for men's clothing; also a similar fabric of wool mixed with cotton or rayon.

Cassini (*käs-sē'nē*), **Jean Dominique (Giovanni)** (1625–1712), French astronomer; discovered four satellites of Saturn; determined rotations of Jupiter, Venus, and Mars; parallax of sun and eccentricity of earth's orbit; work continued by son, **Jacques Cassini** (1677–1756)
 map of world M-91
 polar projection map, *picture* R-88g

***Cassini de Thury*, César François** (1714–84), astronomer, director of Paris Observatory; grandson of J. D. Cassini; work continued by son, **Jacques Dominique de Cassini, Comte** (1748–1845): M-91

Cassini's division, on Saturn P-285, *picture* P-281

Cassino, Italy, city, 75 mi. s.e. of Rome, ancient Casinum; pop. 9208; Monte Cassino monastery nearby destroyed in World War II but was rebuilt: *map* E-425
 World War II W-264, W-280

Cassiodo'rus, Flavius Magnus Aurelius (490?–585?), Latin writer, statesman, and monk ('History of the Goths'; 'Variae', treats of Ostrogothic Kingdom in Italy): B-236–7
 established scriptorium L-181

Cassiopeia (*kăs-i-ō-pē'ya*), in Greek mythology, Ethiopian queen, mother of Andromeda.

Cassiopeia, a northern constellation, *charts* S-373–4, 378–80
 circumpolar stars A-436
 use in telling time and direction, *diagrams* A-429

Cassit'erite, the chief ore of tin; ordinary massive variety called tinstone: T-137, M-262, *table* M-176

Cassius Longinus (*kăsh'ŭs lŏn-gī'nŭs*), **Caius** (died 42 B.C.), Roman general, one of Caesar's murderers; called by Shakespeare "lean and hungry Cassius."

Cassivellau'nus, British king, conquered by Julius Caesar (54 B.C.).

Cas'sowary, bird C-132, *picture* C-132
 related to ostrich O-427

Castagno (*kä-stän'yō*), **Andrea del** (1396?–1457), Italian realistic painter of early Florentine School.

Casta'lia, fountain of, at Delphi; sacred to Muses; waters supposed source of inspiration; now called Fountain of St. John: D-62

Cas'tanets M-472, *picture* M-471

Castanheiro (*käs-tän-yā'rō*), tropical tree (*Bertholletia excelsa*) of lecythis family, native to S. America. Grows to 100 ft.; leaves to 2 ft. long, oblong, leathery, with wavy margins; flowers, white, in loose spikelike clusters. Fruit is the Brazil nut, also called the Para nut, or castanea.

Caste, hereditary division of society according to family, religion, wealth, occupation, etc.
 India H-357, I-58; sandalwood used for mark S-39
 Japan J-318

Castelar y Ripoll (*käs-tā-lär' ē rē pōl'*), **Emilio** (1832–99), Spanish Liberal statesman, orator, and writer; dictator of Spanish republic Sept.–Dec. 1873; author of histories, essays, novels, travel books.

Castelfidardo (*käs-tĕl-fē-där'dō*), Italy, town 10 mi. s. of Ancona, near Adriatic Sea; Italians defeated papal troops 1860.

Castellanos (*käs-tĕl-yä'nōs*), **Julio** (born 1905), artist, born Mexico City; noted as easel and fresco painter, etcher, engraver; precise line, finely balanced forms; skillful stage designs.

Castellón de la Plana (*käs-tĕl-yōn' dā lä plä'nä*), Spain, industrial and trade city 40 mi. n.e. of Valencia, near Mediterranean; pop. 53,331, with suburbs: *maps* E-425

CAT BREEDS AND STANDARDS RECOGNIZED BY AMERICAN CAT FANCIERS

Breed	Type	Class: Color and Markings	Class: Color of Eyes
LONG-HAIRED PERSIAN	**Head**—Round, wide between ears. Nose short and broad. Cheeks and underjaw well developed. Ears small, thin, rounded at tip Eyes large, round, full, wide apart. **Body**—Short and "cobby"; that is, low, deep-chested, massive across shoulders and rump Back straight and firm Legs short and straight Feet rounded and well arched. Tail short, well "feathered," carried without curve. **Coat**—Long and glossy.	White	Golden to copper; blue and golden
		Black	Golden to copper
		Blue	Golden to copper
		Cream	Copper to orange
		Solid red	Golden to copper
		Peke-faced red*	Golden to copper
		Silver (chinchilla)	Blue-green
		Shaded silver	Blue-green
		Silver tabby†	Blue-green
		Smoke (black topcoat, white undercoat)	Golden to copper
		Red tabby†	Copper
		Peke-faced red tabby*†	Copper
		Brown tabby†	Golden to copper
		Tortoise shell (black, orange, and cream)	Golden to copper
		Blue and cream (the two colors clearly defined as in tortoise shell)	Golden to copper
DOMESTIC SHORT HAIR	**Head**—Similar to long-haired cats but may be less full, with slightly longer nose Ears may be wider at base Eyes large, full, round **Body**—Inclined to be longer and more slender than long-haired cats also inclined to stand higher but is not rangy Feet small and tight Tail fairly short and tapering **Coat**—Close-lying and glossy	Color of coat and eye color the same as those of long-haired breed.	
SIAMESE	**Head**—Long and tapering, wide between eyes, narrowing to muzzle, giving impression of a marten face Ears erect, large, pricked, wide at base Eyes almond shaped, with oriental slant toward nose **Body**—Medium to small, dainty, long, svelte Legs slim and straight, with small, oval feet Toes close Tail long and tapering, sometimes having kink at tip. **Coat**—Short, fine textured, glossy.	Seal point‡ (fawn or cream body, seal-brown points)	Clear, vivid blue
		Chocolate point‡ (ivory body, cinnamon-brown points)	Clear, vivid blue
		Blue point‡ (silver-blue body, darker blue points)	Clear, vivid blue
		Lilac (frost) point‡ (glacial-white body, light silver-blue points)	Clear, vivid blue
BURMESE	**Head**—Similar to Siamese **Body**—Similar to Siamese **Coat**—Similar to Siamese	Seal brown shading to lighter color on chest and stomach. Young cats may be lighter in color.	Yellow
ABYSSINIAN	**Head**—Long and pointed Ears sharp and comparatively large and wide. Eyes large. **Body**—Small, long, lithe Tail fairly long and tapering. Feet small Gives impression of being dainty but muscular. **Coat**—Short, fine, close-lying.	Ruddy brown, ticked with black or dark brown like rabbit fur. Inside forelegs and stomach tan or orange brown. Black of pads on feet extends up the backs of the hind legs.	Gold, green, or hazel
MANX	**Head**—Round. Nose broad. Cheeks full Chin firm. Ears large, wide apart, open at base. Eyes large and round. **Body**—Cobby. The Manx has no tail, only a dimple where coccyx ordinarily starts High hindquarters. Short back. **Coat**—Open or "double" Double coat gives Manx appearance of having a short fluffy coat like that of a rabbit.	All colors of Manx are recognized in show specimens.	Varies according to color of coat
RUSSIAN BLUE	**Head**—Skull flat, broad across eyes. Neck and nose fairly long Ears large, wide at base, round at tips. Eyes round and far apart **Body**—Long and graceful Tail long and tapering Legs medium length, with small, neat, rounded feet. **Coat**—Short, thick, fine, standing up like sealskin Fur differs from any other breed since it does not lie flat The coat is double, with outer coat having distinct sheen.	Various shades of blue	Green

*The Peke-faced cat conforms (except for the head and face) to the standard set for the long-haired cat in general and the color class in particular. The head resembles the Pekingese dog with a short nose, deep "stop" between the eyes, and wide, flat head. Cheeks and jaws are firm. Eyes round, large, and full, set wide apart and prominent.

†The tabby markings consist of "frown marks" on the head extending between the ears and down the neck to meet a "butterfly" design on the shoulders, which divides the head lines from the spine. The back markings, or *spinals*, consist of a distinct, wide, dark center stripe with stripes of the ground color on either side, and these in turn bordered by a second dark stripe. Dark swirls on the cheeks and sides of the body make complete unbroken circles and are centered by a large dark spot surrounded by the ground color. Legs are evenly barred with the bracelets meeting the body markings. The tail is also evenly barred.

The word "tabby" is from the French *tabis*, which means a kind of taffeta fabric. Originally this material was made in Attabi, a section of Baghdad. Tabby came to indicate the tabby pattern as well as the material. Then it was used to describe the stripes in the domestic cat's coat In time the word tabby was used to describe a domestic cat of any kind, a confusion which continues today.

‡The "points" of the Siamese—its face mask, ears, legs, feet, and tail—are of a darker shade than the body. The darker fur of the mask and ears is connected except in kittens.

Catapult term for war machines of the crossbow type much used in ancient and medieval warfare for hurling arrows stones etc modern slingshot used by boys works on same principle and is also called catapult M 14 picture W 9
Cataract a waterfall of great volume See in Index Waterfall
Cataracts of Nile N 238 maps E 271 A 45
Catarrhine (kăt a rin) division of monkeys M 353
Catawba Indian tribe few in number now lives in South Carolina map I 106f table I 107
Catawba College at Salisbury N C founded 1851 by Evangelical and Reformed church arts and sciences
Catawba grape G 155
Catawba rhododendron R 148
Catbird song bird of mocking bird family C 137 picture C 137 color picture B 164
eggs C 137 color picture E 268a
nest C 137 color picture B 164
Catboat B 216
Catch-as-catch-can wrestling W 305 pictures W 305–6
Catcher in baseball B 65 69 picture B 63
Catchfly See in Index Silene
Catch stitch in sewing diagram S 113
Catclaw or Texas mimosa tree (Acacia greggi) of pea family native to desert regions from Texas to Mexico 12 ft to 18 ft high branches thorny leaves gray green flowers yellow in short spikes
Catechism manual of instruction arranged in questions and answers used especially in teaching religion
Catechu (kăt ē cho) or cutch a substance obtained from acacia and certain other Asiatic and African plants used in tanning and dyeing Burma production B 360
Caterpillar larval stage of moths and butterflies C 137–8 B 367b pictures C 138 I 156 color pictures P 420a b B 365–7
army worm A 386–7 color picture B 367
cage for picture N 65
cankerworm C 112
corn borer picture I 162
cutworm C 532
destroys vegetation C 138
enemies birds C 138 beetle picture B 104 ichneumon fly picture I 164 wasps W 60
metamorphosis C 137–8 pictures B 367b 368 color pictures B 365 7
monarch butterfly color picture B 365
silkworm S 181–3 pictures S 181 3
Caterpillar tanks See in Index Tanks
Caterpillar tractor trade mark for a tractor built for use on rough ground See also in Index Tractor
Caterpillar wasp W 50
Cates Clifton (Bledsoe) (born 1893) U S Marine Corps officer born Tiptonville Tenn in World Wars I and II commandant U S Marine Corps 1948 52 head of Marine Corps schools at Quantico Va 1952–54 retired
Catesby Robert (1573–1605) English conspirator chief instigator of Gunpowder Plot (1605) conceived idea in May 1603 and later took in Guy Fawkes and others
Cat family the Felidae C 135
Catfish C 138 9 F 114 pictures A 250e M 309
male guards eggs F 106
Catfish electric T 155 156
Catgut V 475
Catharine See in Index Catherine
Cathartidae (ka thar ti dē) the New World family of vultures V 524
Cathedra a seat or throne (Greek) hence ex cathedra (Latin) spoken with authority
Cathedral (ka thē dral) a church containing the official throne of a bishop C 139 picture C 139
Aix la Chapelle picture A 1
Amiens A 235 buttress picture A 315
Antwerp A 270
architecture A 311 18 See also in Index Church architecture
Berlin Lutheran picture B 127
Bogotá picture B 220
Brussels B 334
Burgos S 319
and 2 pictures S 319
Canterbury C 114–15 picture C 115
Chartres sculpture S 78a picture S 78 window picture C 125
Cologne C 386 picture C 386
Cuzco in D 157
England government F 356
Exeter picture F 352
Florence in F 161 B 41
France F 279 F 147 picture F 147
sculpture S 78b picture S 78a
Gloucester picture F 352
Gothic A 315–18
Granada S 320
Honduras at Tegucigalpa picture H 417
libraries medieval L 182
Lima L 243
Lincoln picture E 352
Lisbon L-266
Liverpool L 278
Malaga picture S 322a
Mexico City M 210
Milan I 278 279 pictures I 277 E 440
Moscow Cathedral of the Assumption M 398
Notre Dame Paris See in Index Notre Dame cathedral
Pisa picture P 273
Reims R 96–7 picture C 139
Saint Francis Santa Fe picture S 43a
Saint John the Divine New York City N 320 N 222 pictures A 323 S 78
Saint Mark's Venice I 280 V 445 pictures I 281 V 447
Saint Paul's London L 298 301 A 319 map L 301 pictures L 302 W 190a
Saint Sophia Kiev K 39
Salisbury England picture A 400g color picture P 29c
Santo Domingo picture D 124
Strasbourg A 181
Utrecht U 420
Cathedral bells See in Index Cobsea
Cathedral of Learning University of Pittsburgh skyscraper P 275 picture C 383
Cather Willa Sibert (1875 1947) American novelist and short story writer C 140 A 230e picture C 140
Death Comes for the Archbishop S 43a C 140
Catherine of Alexandria Saint (4th century A D ?) Christian virgin and martyr tortured on a Catherine wheel festival November 25
Catherine of Braganza (1638 1705) queen consort of Charles II of England daughter of John IV of Portugal C 192
Catherine of Siena Saint (1347 80) Italian ascetic and mystic a dyer's daughter persuaded Pope Gregory XI to return from Avignon to Rome festival April 30
Catherine I (1683 1727) empress of Russia wife of Peter the Great and empress after his death (1725) of humble birth she became the wife of a Swedish dragoon and fell into Russian hands at the capture of Marienburg though ignorant and uneducated she had charm and practical intelligence and exercised great influence over Peter P 167
Catherine II the Great (1729 96) German princess who became empress of Russia C 140 R 286 picture C 140
French culture fostered C 140 R 294
Odessa founded by O 340
Orlov diamond D 80
Catherine of Aragon (1485 1536) daughter of Ferdinand and Isabella of Spain and first queen of Henry VIII of England
divorced H 338
Catherine or Katherine of Valois (val wa) (1401–37) daughter of Charles VI of France and queen of Henry V of England H 446
Catherine de Medici (med i chē Italian mā dē chē) (1519 89) queen of Henry II of France M 183
Coligny and C 382
first ballet D 14a h
Catherine Howard (died 1542) 5th queen of Henry VIII H 338
Catherine Parr (1512 48) 6th queen of Henry VIII H 338
Catherine wheels or pinwheels F 93 picture J 341
Catherwood Mary Hartwell (1847 1902) novelist born Luray Ohio successful writings include historical romances of French Canada and Great Lake region (The Romance of Dollard The Story of Tonty Old Kaskaskia The Days of Jeanne D Arc)
Cathode negatively charged electrode in an electrolytic solution or ionized gas I 205
electrolysis E 302
phototube P 209 210 diagram P 210
vacuum tube F 318
X ray and Crookes tubes X 328 329 332
Cathode ray a stream of negative electrons emitted by cathode of vacuum tube
nature and uses F 318
television T 54a c
X rays caused by X 328 329 332
Cathode ray oscilloscope device for detecting deflection of electrons in vacuum tubes F 318 diagram F 319
Catholic Association in Ireland O 337
Catholic church See in Index Roman Catholic church
Catholic Emancipation Act O 337
Catholic League (1576) See in Index Holy League
Catholic League (1609) led by Maximilian I duke of Bavaria A 497 T 118
Catholic Periodical Index M 30
Catholic University of America at Washington D C Roman Catholic established by Pope Leo XIII 1887 opened 1889 schools of sacred theology canon law engineering for men arts and sciences law nursing education social sciences social work graduate school
Catholic Youth Organization (C Y O) founded 1930 at Chicago Ill by Bishop Bernard J Sheil maintains program of religious educational recreational and social service activities for boys and girls
Catiline (kăt i līn) (Lucius Sergius Catilina) (108 62 B C) Roman conspirator C 307
Cation (kăt ī-on) a positively charged ion E 315 I 205
Catkin or ament a scaly spike of flowers on certain trees as willow or birch F 185
Catlin George (1796–1872) ethnologist traveler artist and writer born Wilkes Barre Pa student and painter of American Indians (many Indian paintings in National

a politi al party t) determine in advance the policies and candidates the party will support in a given election C 436
early presidential candidates named by I 358
possible origin of word A 17
primary electi ns versus caucus system P 410
Caudill (*kô d l*) **Rebecca** (born 1899) writer born Cumberland Ky taught in Rio de Janeiro Brazil books for older girls include Barrie & Daughter' and 'Tree of Freedom' For younger children she wr te a series of books based on her child hood in the mountains of Kentu ky Happy Little Family hool house in the Woo ls Up and n the River
Caudillos (*kou-dēl yōs*) dictators in Spanish speaking countries
Francisco Franco F 277 *picture* F 277
Latin America L 114 S 278 A 337
Caudine Forks mountain pass in Samnium 25 mi n e of Naples where 40 000 Romans surrendered (321 B C) in 2d Samnite War
Cauliflower vegetable of cabbage type C 1 *pictures* C 2 N 47
when and how to plant *table* C 19
Caulk *See in Index* Nautical terms table
Caura (*kou ri*) **River** tributary of the Orinoco River in central Venezuela flows n 450 mi *maps* V 442 S 252
Caustic a substance which destroys living tissue Common caustics are household lye (sodium hydroxide) carbolic acid chromic acid arsenic silver nitrate
Caustic potash or **potassium hydroxide** often called lye when dissolved in water P 389 390
antidote for F 96
mercerizing M 173
soapmaking S 211
Caustic soda or **sodium hydroxide** often called soda lye S 225
alkaline properties A 9
by product chlorine C 288
cellulose xanthate use in C 162
electrolytic production S 226
mercerizing cloth M 173
papermaking P 67
soapmaking S 211 S 225
Cauto (*kä ŏ tō*) river in s e Cuba flowing w to coast navigable for small craft C 526 *map* C 528
Cauvery (*kô vēr i*) **River** in s India flows 475 mi through Mysore and Madras into Bay of Bengal *maps* I 53 54
irrigation system M 26
Cavalieri (*kä vä lē yä rē*) **Bonaventura F** (1598–1647) Italian mathematician and astronomer invented method of indivisibles first published in 1635
Cavalieri Lina (1874–1944) Italian opera singer principal roles La Bohème La Traviata Mignon was married to Lucien Murat re 1914–27 killed in a bombing raid on Florence Italy
Cavalier Parliament in England E 367
Cavalier poets name applied to group of English lyric poets of 17th century among whom were R hard Lovelace Sir John Suckling Robert Herrick and Thomas Carew poems are courtly light and sophisticated P 378
Cavaliers Royalists in English Civil War C 191
type of wig worn *picture* C 192
Cavalleria Rusticana (*kä v äl lē rē ä rōs tē kä nä*) opera by Mascagni O 390
Cavalli (*kä väl lē*) **Francesco** (Pietro Francesco Caletti Bruni) (1600?–1676) Italian composer of sacred and dramatic music O 388
Cavalo island at mouth of Manila Bay M 77
Cavalry *See also in Index* Armor U S Army
ancient W 8 Assyrians B 8 Roman legion W 9
Roman legion W 9
sabers S 455
trumpet B 342
U S Army A 379
Cavan (*kăv ăn*) inland agricultural and mining county in n part of Ireland 730 sq mi pop 66 377 *map* I 227
Cavanna Betty (Mrs Elizabeth Cavanna Headley) (born 1909) author born Camden N J engaged in newspaper work advertising and art wrote short stories and books for teen aged girls (A Girl Can Dream Paintbox Summer Spring Comes Riding Lasso Your Heart Love Laurie)
Cave C 156–8 *pictures* C 156 7
Carlsbad Caverns C 157 N 31 *color picture* N 22 *map* N 18
Fingal's Cave C 158
Jewel Cave N 36 *map* N 18
Lehman Caves N 36 *map* N 18
Luray Cavern *picture* C 157
Mammoth Cave C 156–7 N 36 *maps* K 23 N 18 *pictures* C 157
monastery in Russia K 39
Oregon Caves N 38 *map* N 18
Shoshone Cavern N 38c *map* N 18
temples Hyderabad H 455
Timpanogos Cave N 38c *map* N 18
Wind Cave S D N 38c *map* N 18
Cave bear prehistoric animal larger than polar bear one of fiercest enemies of cave man fossils in caverns of Europe and Asia F 244
Cave dwellers M 63–4 66 70 A 301–2 *pictures* M 64 *color picture* M 67
American I 108f
art M 64 D 140 *pictures* M 63–4 D 140 *color picture* M 67
Basket Makers B 76
China *picture* C 258
Cro Magnons M 63–4 70
lamps and lighting L-88
modern C 158
racial classification *chart* R 22
weapons and tools S 401 *picture* S 401
Cavell (*kăv l*) **Edith** (1865–1915) English nurse attached to hospital in Brussels executed by German military government of Belgium in World War I for aiding wounded Allied soldiers to escape
Cavendish Henry (1731–1810) English chemist and physicist born Nice France valuable discoveries in electricity proved hydrogen an element and water a compound
electrical discoveries F 308
hydrogen discovered by C 221
phlogiston theory I 138 9 *diagram* weighs earth E 192–3 *diagram* E 194
Cavendish Spencer Compton *See in Index* Devonshire 8th duke of
Cavendish Thomas (1555?–92) English navigator second Englishman to circumnavigate the globe
Cavendish Victor Christian William *See in Index* Devonshire 9th duke of
Caviar (*kăv i är*) a salty relish made of roe of sturgeon or other fish especially in Russia S 434
Cavite (*kä vē tā*) port 8 mi s w of Manila pop 35 05 M 77
Cavour (*kä vōōr*) **Camillo Benso Count di** (1810–61) Italian statesman C 158 I 273
Garibaldi and G 21
Victor Emmanuel II and V 468
Cavy *See in Index* Guinea pig
Cawein (*kä wīn*) **Madison Julius** (1865–1914) poet born Louisville Ky ('Kentucky Poems' 'Blooms of the Berry' 'Minions of the Moon')
Cawnpore (*kôn pōr* or *kôn pur*) or **Kanpur** India, industrial city on Ganges River pop 705 383 *maps* I 54 64 A 407
massacre G 9
Caxton William (1422?–91) first English printer T 230 E 376–7
first English language encyclopedia P 88d
printer's mark *picture* T 230
type used by *picture* B 235
Caxton Memorial Bible B 137
Cayenne (*kī ĕn* or *kā ĕn*) capital chief town and seaport of French Guiana on island of Cayenne pop 10 961 gave name to Cayenne pepper formerly French penal colony *maps* G 223 S 252
Cayenne pepper P 143
Cayes Haiti *See in Index* Aux Cayes
Cayman or **caiman** reptile of the crocodile type C 515
Cayman (*kī măn*) **Islands** British West Indies dependency of Jamaica consisting of Grand Cayman Little Cayman and Cayman Brac The first much the largest area about 93 sq mi cap George town the other two about 10 mi ne total pop about 7000 exports mahogany logs thatch rope turtles, coconuts *maps* C 528 W 96
Cayuga (*kā ū gă*) Indian tribe of Iroquois group originally living about Cayuga Lake N Y moved to Canada during the Revolutionary War *table* I 107
Cayuga Lake in central New York 35 mi long on it are Ithaca Aurora and Cayuga *maps* N 196 204 *picture* L 400
Cayuse (*kī ūs*) a horse H 428*l*
Cayuse Indians tribe of the Waiilatpuan linguistic stock in Oregon and Washington The cayuse pony introduced by the whites was named for this tribe
Cazin (*kä zăn*) **Jean Charles** (1840–91) French painter and designer of ceramics noted for landscapes and for religious paintings
"C" **battery** in radio R 37 40
CCC *See in Index* Civilian Conservation Corps
CCC *See in Index* Commodity Credit Corporation
Ceara (*sā ä rä*) state of Brazil on n seacoast 57 31 sq mi pop 2 735 702 cap Fortaleza (or Ceará) B 291 *maps* B 288 S 252
Cebidae (*sĕb ĭ dē*) New World monkey family M 353
Cebu (*sā bōō*) one of Philippine Islands 1695 sq mi products mainly agricultural cap and chief seaport is town of Cebu on e coast pop 167 503 trade center *maps* P 195 A 407 *picture* P 199
Magellan at M 32
Cecchetti (*chĕ kĕt tē*) **Enrico** (1850–1928) Italian dancer and ballet teacher at Imperial School of Ballet 1890 1902 taught Pavlova Nijinsky Massine instructor for Diaghilev ballet D 14h
Cecil great English family most famous members William Cecil Lord Burghley great minister of Queen Elizabeth I and marquis of Salisbury Victorian premier *See* Cecil *below* and *also in Index* Burghley William Cecil Salisbury Robert Cascoyne Cecil marquis of
Cecil E A Robert Cecil first viscount of Chelwood (born 1864) British statesman son of marquis of Salisbury entered Parliament 1906 held various high offices minister of blockade 1916 advocate of League of Nations received first

ā=French *u* German *ü* *gem* *go* *thin* *then* *n*=French nasal (Jean) *zh*=French *j* (*z* in azure) *K*=German guttural *ch*

Cemetery Ridge in battle of Gettysburg G 105 106

Cenis (*sŭ nē*) Mont mountain and pass of Alps situated on border of France and Italy *map* I 262
Mont Cenis Tunnel T 209

Cenote (*sĕ nō tĭ*) natural underground reservoir of water Y 345

Cenozoic (*sē nō zō ĭk*) era in geology G-56-7 *diagrams* G 52 58 *table* G 57
animals *pictures* M 61

Censer incense burner *picture* F 444

Censitaires (*săn sē tĕrs*) French Canadian tenant farmers of 17th century who were employed by the seigneurs

Censors Roman R 184

Censorship
advertising A 25 postal rules A 24
communication facilities C 424c
radio P 49 50
motion pictures M 431
Russia R 271

Census C 167–70 *pictures* C 168
Constitutional provision U S 1 349
Domesday Book W 137

Census Bureau of the U S C 168–70 *pictures* C 168
census taker *picture* S 385a
microfilm *use of* M 230–1
recording statistics C 185 C 168 70 *pictures* C 168 S 386b
supplementary censuses C 169 70

Cent a coin of the U S weighing 48 grains (95 per cent copper 5 per cent tin and zinc) and valued at the hundredth part of a dollar first issued by U S mint in 1787 sometimes called penny

Centaur (*sĕn tôr*) fabled monster half man half horse C 170–1 *picture* C 170

Centaur The by Maurice de Guérin book famous for its fine printing in Bruce Rogers edition *pictures* B 235 239

Centaur beetle a large West African scarabaeid beetle B 108

Centaurea (*sĕn tạ rĭ ạ*) genus of plants of the family *Compositae* includes bachelor s button star thistle sweet sultan knapweed and dusty miller
how to plant, *table* G 16

Centaurus a southern constellation contains Alpha Centauri the nearest fixed star *charts* S 375 6

Centavo (*sĕn tä vō* or *thĕn tä vō*) a copper coin historical value 1 cent or a fraction used in South and Central America Cuba Mexico Portugal Philippines circulates also in pieces of 5 10 centavos etc

Centenary (Latin *centenarius* a hundred) a period of 100 years

Centenary College at Shreveport La Methodist founded 1825 arts and sciences

Centennial (Latin *centum* a hundred plus *annus* year) completion of 100 years associated with 100th anniversary *e g* centennial celebration

Centennial Exhibition international exhibition of manufactures arts agricultural and mineral products held at Fairmount Park Philadelphia (1876) to celebrate the 100th anniversary of American independence

Centennial State (Colorado) C 401

Center in European politics P 360

Center of circle *diagram* G 61

Centerboard *See in Index* Nautical terms *table*

Center of gravity *See in Index* Gravity center of

Centesimo (*sĕn tĕs ĭ mō*) 100th part of the Italian lira of the peso of Uruguay and Panama basis of minor coins of small value

Centigrade thermometer T 116 *picture* T 116

Centigram a unit employed in the metric system (01 gram or 0 154 grains) M 184

Centiliter unit in metric system (10 c c or 0 338 fl oz) M 184

Centime (*sän tēm*) a copper coin historical value 1 100th of a franc or a small fraction of a cent used in Belgium Switzerland Haiti 5 centimes smallest French coin

Centimeter unit in metric system (01 meter or 0 3937 in) M 184

Centimeter gram second (C G S) system measurements of motions forces and work which use centimeters for distance grams for mass and seconds for time Yields measurements of force in dynes and of work in ergs

Centimo the 1 100th part of the Costa Rican colon Venezuelan bolivar Spanish peseta a coin worth a fraction of a cent

Centipede a type of many legged arthropod C 171
luminescence P 208
place in family tree of animal kingdom *picture* A 251

Centlivre (*sĕnt lĭv ĕr* or *sĕnt lē vĕr*) *Susannah* (1667 1723) English actress and dramatist (comedies *The Wonder* A Woman Keeps a Secret one of David Garrick s successes and *A Bold Stroke for a Wife*)

Central African Federation *See in Index* Rhodesia and Nyasaland Federation of

Central America, southern part of North America extending from Mexico to Colombia 220 000 sq mi pop 8 900 000 C 171 8 *maps* C 172 N 245–6 251 *pictures* C 173–7 *Reference Outline* N 266 *See also in Index* Latin America names of separate countries
bibliography N 266
Caribbean Sea C 122
climate C 171 172 animal and plant life varies with *map* N 258
commerce C 175–6
education C 174
food C 173–4 *color picture* I 88
history C 176–7 *map* A 189 Columbus C 419 Balboa B 19 20 Drake D 128 Independence Day F 59 Mayan civilization M 143a 4 *map* Y 345 *pictures* M 143a–4 Pan American conferences L 120 2 American *See also in Index* America, discovery and exploration
illiteracy C 174
Monroe Doctrine M 365–6
natural features C 171 2
Panama Canal P 53 63 *map* P 62 *pictures* P 53–5 57 61
people C 172 4 *picture* C 174
products C 171 175 bananas C 175 chicle C 227 *picture* C 176 coffee C 171 172 175 C 380 logwood L-298 mahogany M 44 45 *picture* C 175 yucca Y 345
relationships *in* continent, *maps* N 245 6 248 250–1 258
religion C 174 5
shelter C 173 174 *pictures* C 174–5
transportation and communication C 176
vegetation *map* N 258

Central American Federation union of former Spanish provinces formed in 1823 dissolved in 1842
flag (El Salvador) F 138 *color picture* F 136

Central Asia another name for Turkestan T 213
Soviet Republics of T 214

Central Australia an administrative division of Australia from 1926 to 1931 at which time it was reunited with North Australia to form once more the Northern Territory its area was 236 400 sq mi

Central banks *See in Index* Banks and banking *subhead* central

Central City Colo town 30 mi w of Denver altitude 8560 ft pop 371 once a rich mining town since 1932 noted for its summer opera and theater season sponsored by University of Denver *map* C 409

Central College at Fayette Mo Methodist chartered 1855 opened 145 arts and sciences

Central College at Pella Iowa affiliated with Reformed Church chartered 1853 opened 18 4 arts and sciences music

Central Committee of the All Union Communist party P 282

Central Falls R I city 4 mi n of Providence on Blackstone River which supplies power for textile mills pop 23 550 *map* R 141

Central heating or district heating H 324

Central Highway in Cuba C 527

Centralia Ill manufacturing city 57 mi e of St Louis Mo fruit coal petroleum pop 1 863 *map* I 37

Central India former collection of princely states in India was supervised by President for Central India (with headquarters at Indore) assisted by political agents now part of Madhya Bharat and Vindhya Pradesh states *map* I 68a

Central Intelligence Agency U S government U 358

Central Michigan College of Education at Mount Pleasant Mich state control opened 1892 liberal arts business administration education graduate study in elementary education

Central Missouri State College at Warrensburg Mo state control founded 1871 liberal arts education graduate study in education

Central nervous system N 110 *See also in Index* Nervous system *subhead* central

Central Pacific Railroad one of links in first transcontinental line in the United States completed in 1869
California C 48
completion of *picture* U 382

Central Park New York City N 223 P 86a *map* N 222 *picture* N 220 *color picture* 36

Central pit or fovea centralis of eye E 460 *diagram* E 459

Central Plains U S U 251 255 *map* U 250 *See also in Index* United States *subhead* geographic regions (North Central Plains Great Plains)

Central Powers World War I W 216

Central Provinces (with Berar) former province of India now part of Madhya Pradesh state *map* I 68a

Central State College (Ohio) at Wilberforce state control *state supported adjunct to* Wilberforce University 1887 1947 named Central State College 1951 arts and sciences education

Central State College (Okla) at Edmond state control opened 1891 arts and sciences education

Central Statistical Board (CSB) U S government R 205

Central tendency in statistics S 385a

Central time T 136 *map* U 252 3

Central Valley California C 26 *See also in Index* Great Valley

Central Valley Chile C 50 252 S 270

Key: cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wȯn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn; out;

Chandelier a lighting fixture
enamel *picture* L-90
Georgian *pictures* I 180 183
in Flemish home (15th century) color *picture* P 250
in White H use *picture* W 124
Queen Anne *picture* I 179

Chandernagor (*chŭn dẽr nä gōr*) or **Chandernagore** India settlement on Hooghly River 20 mi above Calcutta 4 sq mi pop 47,8 granted to France 1688 twice taken by British and twice restored to French held by France 1816–1950 joined India 1950 map 168a A 407

Chandigarh (*chŭn dē gär*) capital of Punjab state n w India about 160 mi n of New Delhi totally planned by group of famous architects, notably Le Corbusier of France inaugurated 1953

Chandler Albert Benjamin (Happy) (born 1898) public official born Corydon Ky governor of Kentucky 1935–39 U S senator 1939 45
high commissioner of baseball B 72

Chandler Anna Curtis (born 1884?) storyteller born Brunswick Me began telling illustrated stories in Metropolitan Museum of Art New York City 1919 ('Magic Pictures of Long Ago' 'Story Lives of Master Artists')

Chandler Zachariah (1813–79) political leader born Bedford N H foe of slavery helped form Michigan Republican party U S senator 1857–75 secretary of interior 1875–77 re elected to Senate 1879
See also in Index Statuary Hall (Michigan) *table*

Chaney Lon (1883–1930) character actor in motion pictures born Colorado Springs Colo called the man with a thousand faces developed art of facial expression and pantomime in trying to communicate with his deaf mute parents notable work in 'The Miracle Man' 'The Hunchback of Notre Dame'

Chang and Eng *See in Index* Siamese twins

Changchun (*chang chun*) formerly **Hsinking** (*shin ging*) Manchuria city in Kirin province about 300 mi from coast on railroad connecting Peking and Mukden pop 630,049 M 75 *maps* M 72 A 406

Change of state in matter E 344c–d, M 142a
kinetic theory M 142b

Chang Pai (*ching bī*) Mountains range on Manchuria Korea border highest point about 9000 ft *map* M 72

Changsha (*chäng shä*) China city 350 mi n of Canton on Siang River cap of Hunan province pop 396,465 silk manufactures large native trade Yale University mission school *maps* C 259 A 407

Chang Tso lin (*chang sō lēn*) (1873–1928) Chinese war lord magnificent dictator of Manchuria defeated by Nationalist forces in 1928 killed when bomb wrecked train in which he was fleeing

Channel bass *See in Index* Drum

Channel catfish C 138–9

Channeled top (*Calliostoma doliarius*) snail
shell color *picture* S 139b

Channeling machine used in quarrying Q 3

Channel Islands British possession off coast of France 75 sq mi pop 102,776 C 185 *maps* F 259 B 325, *picture* C 185
cattle Guernsey C 144 *pictures* C 141 141b *table* C 142 Jersey C 145 *picture* C 141b *table* C 142
Elizabeth Castle *picture* C 185
Jersey cabbage C 1

Channel Islands National Monument in California N 32 *map* N 18

Channing Edward (1856 1931) historian born Dorchester Mass professor of ancient and modern history at Harvard life work his history of U S from arrival of Norsemen to present sixth volume won Pulitzer prize 1925

Channing William Ellery (1780 1842) Unitarian preacher reformer and writer born Newport R I and writer born Newport R I abhorred slavery but deprecated violence of abolitionist
Hall of Fame *table* H 249

Chanson de Roland (*shän sôn de rô län*) (Song of Roland) R 178

Chansons de Geste (*shän sôn de zhest*) songs of great deeds French chivalric epics written in verse and sung by minstrels the best known is the Chanson de Roland celebrating the hero of Charlemagne's army
Roland epic R 179
Song of Roland R 178

Chant in church music a type of musical declamation especially of the psalms adapted Gregorian the psalms a chant lends free rhythm chant in unison with free rhythm Anglican chant harmonized and more metrical
Gregorian 214 M 459

Chant in poetry L 333

Chantecler (*shän t klēr*) play by Edmond Rostand satirizing human weaknesses hero is Chantecler (Chanticleer) the cock and other characters are birds and animals of the farmyard

Chanter in bagpipe B 17

Chanterelle a mushroom *See in Index* (Cantharellus cibarius

Chantey songs or **shanty songs** work songs F 197–8

Chanticleer the Cock (French *chante clair* clear singer) popular character in old beast epic
Chaucer's tale C 203
Reynard the Fox story F 254

Chantilly (*shän tē yē*) France ancient town 26 mi n of Paris pop 5105 splendid château art collection once noted for Chantilly lace famous racecourse
porcelain *picture* P 393

Chantilly (*shan tĭl ĭ*) Va village 20 mi w of Washington indecisive battle after 2d battle of Bull Run (1862) generals Kearny and Stevens killed also called battle of Ox Hill

Chantilly lace L 78 *picture* L 79

Chantrey Sir Francis Legatt (1781 1841) English sculptor (equestrian statues of Duke of Wellington and George IV also statues of George III and George Washington)

Chanukah *See in Index* Hanuka

Chanute (*sha nut*) **Octave** (1832–1910) American civil engineer and inventor of flying machines born Paris France
gliders A 101 *picture* A 101

Chanute (*sha nut*) Kan city 95 mi s of Topeka pop 10,109 cement plant railroad shops oil industries chicken hatcheries city airport *map* K 11

Chaos (*kā ŏs*) in Greek mythology most ancient of the gods lord of disorder father of Erebus and Nox

Chapais (*sha pē*) **Sir (Joseph Amable) Thomas** (1858–1946) Canadian historian born Quebec province Canada ('Jean Talon' 'Le Marquis de Montcalm (1712 1759)' 'Cours d'Histoire du Canada' 8 vols)

Chapala (*cha pa la*) **Lake** in Mexico 70 mi long and 20 mi wide between states of Jalisco and Michoacan *maps* M 189 194

Chaparejos (*chä pa-ra hos*) or **chaps** (*sl ps*) leggings worn by cowboys C 154 *picture* C 152

Chaparral (*chap a răl*) thicket of dwarf oak shrubs etc found in parts of Texas New Mexico Arizona and Mexico

Chaparral cock *See in Index* Road runner

Chapbook a small illustrated book or pamphlet sold by peddlers or chapmen to the common people of England in the 17th and later centuries containing ballads tracts and old romances

Chapei section of Shanghai S 133

Chapel Hill N C university town 25 mi w of Raleigh pop 9177 University of North Carolina *map* N 274

Chaplain clergyman attached to army or navy
U S Army A 380 insignia *pictures* I 238

Chaplin Charles Spencer (born 1889) English motion picture comedian and producer born London began career in music halls and in vaudeville stage came to U S 1910 screen debut 1914 made home in England after Sept 1952 famous for masterly pantomime and for eccentric baggy costume ('Shoulder Arms' 'The Kid' 'The Gold Rush' 'The Circus' 'City Lights' 'The Great Dictator' 'Monsieur Verdoux' 'Limelight')

Chapman Frank M (1864 1945) ornithologist born Englewood N J important contributions to study of bird life ('Handbook of Birds of Eastern North America' 'Bird Studies with a Camera' 'The Distribution of Bird Life in Ecuador')
quoted B 188

Chapman George (1559?–1634) English poet and dramatist noted chiefly as earliest English translator of Homer and one of best (read Keats sonnet 'On First Looking into Chapman's Homer')

Chapman John *See in Index* Apple seed Johnny

Chapman Maristan pseudonym of Mary Chapman (born Chattanooga Tenn 1895) and John Stanton Higham Chapman (born London England 1891) wife and husband American coauthors of novels that depict with sympathy and penetration the mountaineers of the American South ('The Happy Mountain' 'Homeplace' 'Rogues March' 'Tennessee Hazard') also wrote books for boys and girls

Chapman Oscar Littleton (born 1896) public official born Omega Va chief probation officer 1924–27 of Juvenile Court of Denver under Judge Benjamin B Lindsey assistant secretary of interior 1933 46 served as undersecretary of interior 1946 49 secretary of interior 1949 53

Chapman William (1850–1917) French Canadian poet ('Les aspirations' 'Les rayons du nord')

Chappati (*cha pat ĭ*) Indian unleavened pancake I 58
preparation *picture* I 60

Chaps (*shaps*) leggings worn by cowboys C 154 *picture* C 152

Chapter cathedral C 302

Chapultepec (*cha pol tē pek*) Mexico rocky eminence 3 mi s w of Mexico City
battle in Mexican War (1847) M 186
castle *picture* M 186 conference in World War II L-122

Charles X (1622–60) king of Sweden nephew of Gustavus Adolphus ruled 1654–60 engaged in wars with Poland and Denmark won Scania and other Danish provinces S 466
Charles XI (1655–97) king of Sweden son of Charles X became king 1660 defeated Danes 1676 stabilized financial status of country strengthened army and navy S 466
Charles XII (1682–1718) king of Sweden C 195 *picture* C 195
Charles XIV John (1763–1844) king of Sweden *See in Index* Bernadotte Jean B J
Charles XV (1826–72) king of Sweden son of Oscar I ruled 1859–72 reign outstanding for legal reforms
Charles (born 1903) Belgian prince (Duke of Flanders) regent Sept 1944–July 1950 to serve for his brother Leopold III who was in exile
Charles of Anjou (1226–85) king of Anjou and king of Two Sicilies F 146 S 176
Charles the Bold duke of Burgundy (1433–77) C 195–6
tomb at Bruges B 332
Charles Prince duke of Cornwall (born 1948) heir apparent to the throne of Great Britain E 334i *picture* E 334i
Charles Ezzard (born 1921) Negro boxer born Lawrenceville Ga heavyweight champion B 272 *table* B 272
Charles Jacques A C (1746–1823) French physicist first to experiment with gas balloon B 34
Charles's law of gases G 28 *diagram* G 29
Charles Albert (1798–1849) king of Sardinia succeeded 1831 strove to free Italy from Austrian rule (1848–49) but defeated at Custozza and Novara abdicated in favor of son Victor Emmanuel II
Charles Borromeo Saint *See in Index* Borromeo Saint Carlo
Charles City Iowa town 43 mi nw of Waterloo pop 10 309 farm equipment *map* I 215
Charles Edward (1720–88) the Young Pretender E 410
Charles's law or **Gay-Lussac's law** a basic law of gases G 28, *diagram* G 29
Charles Martel (688?–741) Frankish ruler defeated Saracens C 196
Charles River river in Mass rising at Hopkinton flows s to point 5 mi from R I line turns n e to Boston emptying into Boston Harbor total length about 86 mi *maps* M 124 *inset* M 132
Boston on B 258
Charleston Ill city in e center 40 mi w of Terre Haute Ind pop 9164 agricultural region railroad shops shoe manufactories Lincoln Douglas debate 1858 Eastern Illinois State College *map* I 37
Charleston S C city in s e of state pop 70 174 C 196–7 *maps* C 197 S 291 U 253 *picture* C 196
Castle Pinckney N 32 *map* N 18
colonial trading center A 195–6
Cooper River Bridge *See in Index* Bridge *table*
cypress gardens *picture* S 282
earthquake E 196
history C 196 S 284 294
Civil War C 333 337 *map* C 334
Fort Sumter F 242a–b *map* C 334 *picture* F 242b
navy yard *See in Index* Charleston Navy Yard
Pulaski defends P 435
Charleston W Va state capital and river port on Kanawha and Elk rivers pop 73 501 C 197 *maps* W 106 U 253 *picture* W 110
Capitol State *picture* W 110
Charleston College of at Charleston S C opened 1790 (chartered 1785) arts and sciences
Charleston Navy Yard in South Carolina on Cooper River about 10 mi n of city of Charleston established 1901 builds destroyers and small vessels and repairs gunboats auxiliaries and destroyers
Charlestown Mass formerly separate city now part of Boston navy yard battle of Bunker Hill Massachusetts state prison
Charlestown Navy Yard *See in Index* Boston Navy Yard
Charles V Bob Mountains a mountain range in the Antarctic continent
Charlevoix (*shar le voi'*) **Pierre F X de** (1682–1761) French Jesuit missionary and historian explored Great Lakes and Mississippi River (1721)
Charlière (*shar lir'*) early type of balloon B 34
Charlock see *ifally* wild mustard (*Brassica arvensis*) but name sometimes applied to any yellow flowered weed of mustard family *color* *picture* F 180
Charlot (*shar lo'*) **Jean** (born 1898) American artist born Paris France to U S 1929 became citizen 1939 well known for murals and color lithographs illustrated children's books Child's Good Night Book and Two Little Trains by Margaret Wise Brown Secret of the Andes by Ann Nolan Clark and Now Miguel (1954 Newbery award) by Joseph Krumgold
illustrations *picture* S 422
Mother and Child *picture* A 400d
Charlotte empress of Mexico *See in Index* Carlota
Charlotte (*shär'löt*) grand duchess of Luxemburg (born 1896) succeeded to throne 1919 at abdication of her elder sister L 554
Charlotte N C largest city of state pop 134 042 C 197 *maps* N 274 U 253 *picture* N 278
Mecklenburg Declaration of Independence N 279 C 197
Charlotte Amalie (*a mal yé*) formerly St Thomas capital and chief port of U S Virgin Islands at head of St Thomas Harbor island of St Thomas pop 11 469 *map* *inset* W 96a
harbor *picture* W 93
Charlottenburg (*shar lot en burk*) Germany section of Berlin site of former royal palace
Charlottesville Va on Rivanna River 67 mi n w of Richmond pop 25 969 woolen cloth rayon nylon textiles seat of University of Virginia founded 1819 by Thomas Jefferson homes of Thomas Jefferson and James Madison nearby *maps* V 486–7 U 253
university *picture* V 492
Charlottetown Prince Edward Island provincial capital pop 15 887 fine harbor fox fur and fish interests pork packing plant various manufactures Prince of Wales College St Dunstan's University P 412 *map* C 73 *picture* P 411
birthplace of Canadian Confederation C 99
Charm an incantation or object believed to bring good luck M 34 36
Charm in personality E 404
Charmeuse (*sh r mûz'*) a soft light weight satin of subdued luster Cotton charmeuse is a highly mercerized light cotton of satin weave
Charnisay Charles de Menou Seigneur d'Aulnay (died 1650) French governor of Acadia 1635–50 known for dispute over governorship with Charles de La Tour
Charnock Job (died 1693) English traveler went to India about 1655 founded Calcutta C 21
Charnwood Godfrey Benson first Baron (1864–1945) English biographer (Abraham Lincoln Theodore Roosevelt)
Charon (*kâ'ron*) in Greek mythology ferryman of River Styx H 241
Charpentier (*sh r pä tyé'*) **Gustave** (born 1860) French composer born Dieuze near Nancy France studied composition under Massenet won Prix de Rome 1887 member Institute of France member Legion of Honor Ino n for opera Louise also wrote Impressions d'Italie orchestral suite
Louise story O 391
Charque (*chär'ké*) dried beef E 290
picture B 291
Charro (*char'rō*) in Mexico M 210
picture M 198
Chart navigators N 74 76
compass rose *picture* N 75
Chart *See in Index* Graph
Charter act of incorporation
American Colonies A 193
corporations C 487
medieval cities D 64
municipalities M 450 1 C 323 323a
Chartered accountant one who has met the requirements of an Institute of Chartered Accountants of the British Empire and has been given a certificate corresponds to certified public accountant in U S
Chartered companies T 165
Charterhouse a Carthusian monastery in London after 1611 used as a hospital for old men and a school for boys
Charter Oak historic tree at Hartford Conn blown down in 1856 site marked by Charter Oak monument C 450 *picture* C 450
Charter Oath (Japan) J 320
Charter of Liberties of Henry I of England H 335
Charter of Liberties and Privileges in colonial New York N 214
Charters Towers Australia gold mining town in Queensland 80 mi s w of Townsville n e coast pop 7367 *map* A 489
Chartier (*shar tyā'*) **Alain** (flourished early 15th century) French writer born Bayeux France secretary to Charles VI and Charles VII (poems Le livre des quatre dames and La belle dame sans merci political prose Le quadrilogue invectif)
Chartism radical movement in England culminating between 1840 and 1848 sought reform in parliamentary representation and universal adult male suffrage E 369c
Chartres (*shar'tru*) France manufacturing city 45 mi s w of Paris pop 23 509 famous 13th-century cathedral occupied by Germans 1870 and 1940 *map* F 425
cathedral sculptures S 78a *picture* S 78 window *picture* G 125
Chartreuse (*shar trûz'*) **La Grande** original mother house of Carthusian monks M 355
Charybdis (*ka rib'dis*) in Greek mythology whirlpool in Straits of Messina O 344
Chase Harry Woodburn (1883–1955) educator born Groveland Mass professor of psychology and later president University of North Carolina president University of Illinois 1930–33 chancellor New York University 1933–51
Chase Mary Ellen (born 1887) author born Blue Hill Me teacher of English at Smith College 1926–55 novels Mary Peters Silas Crockett and Windswept are dis

tinguished for their serenity and poise: 'A Goodly Heritage' and 'Goodly Company' are autobiographical

Chase, Richard (born 1904) folklorist and authority on English-American dances born Huntsville, Ala.; made home in Charlottesville, Va. His books for children are collections of old stories games etc: 'Jack Tales' 'Grandfather Tales' 'Hullabaloo and Other Singing Folk Games'; 'Wicked John and the Devil'

Chase, Salmon P. (1808–73), statesman born Cornish N H: leading Free-Soiler, early known as "attorney general of fugitive slaves", secretary of treasury (under Lincoln); as chief justice of U S Supreme Court (1864–73) presided at impeachment trial of President Johnson
- in Lincoln Cabinet, *picture* L-249
- portrait on $10 000 bill *table* M-339

Chase, Samuel (1741–1811), jurist, born Somerset County Md, signer of Declaration of Independence, associate justice U S Supreme Court, impeached for partisanship but not convicted; case important in history of American judiciary
- signature reproduced D-37

Chase, Stuart (born 1888), economist and writer born Somersworth, N. H.; on staff of Federal Trade Commission and later of Labor Bureau ('The Economy of Abundance', 'Rich Land Poor Land', 'Tomorrow's Trade', 'The Proper Study of Mankind')

Chase, William Merritt (1849–1916), landscape portrait still life genre painter, born Williamsburg Franklin County, Ind ('Alice', 'Flying Clouds', portrait of James Abbott McNeill Whistler); successful teacher.

Chase, in printing *See in Index* Form

Chasing, a type of engraving in metalwork E-337, *picture* S-187

Chasins, Abram (born 1903), pianist and composer, born New York City; debut soloist with Philadelphia Orchestra, playing own composition, 1929; taught at Curtis Institute 1926–35 at Berkshire Music Center 1940 ('Concerto in F Minor'; 'Parade'; 'Three Chinese Pieces').

Chassis (*chăs'is*, French *shä-sē'*), automobile, *pictures* A-509–10

Chat, a warbler W-7

Château (*sha-tō'*), French term for castle or manor house C-134–5
- famous French châteaux F-264: Chenonceaux, *picture* F-271

Chateaubriand (*shä-tō-brē-äṅ'*), **François René, vicomte de** (1768–1848), French author and statesman (ambassador to London, Berlin, Rome, foreign minister); opposed excesses of French Revolution; exquisite prose stylist; his 'Atala' (later a part of 'The Genius of Christianity') was one of the works that marked beginning of romantic movement in French literature.

"Chateau Clique," political clique in Canada Q-8
- Papineau and P-71

Château d'If (*dēf*), island near Marseilles, France, made famous by Dumas's 'Count of Monte Cristo': M-102

Châteaudun (*shä-tō-dǔṅ'*), France, town near Loire River 70 mi. s.w. of Paris; pop. 7309; old castle of counts of Dunois; burned by Germans in Franco-Prussian War 1870.

Château Frontenac (*frŏn'tĕ-năk*, French *frôṅ-tŭ-näk'*), hotel in Quebec Q-10, *picture* Q-9

Château Gaillard (*gä-yär'*), famous castle in Normandy, 50 mi. n.w. of Paris on Seine River, now in ruins R-150, *picture* N-243

Château-Thierry (*tyĕ-rē'*), French town 47 mi. e. of Paris; pop. 7283: C-198, W-229, 230, *maps* W-217, E-425
- monument, *picture* F-267

Chatelier, Henry Louis Le. *See in Index* Le Chatelier, Henry Louis

Chatham (*chăt'am*), **William Pitt, first earl of** (1708–78), British statesman C-198
- American colonial policy C-198, R-125
- French and Indian War F-285, W-181
- Seven Years' War S-107

Chatham, England seaport 25 mi. s e. of London on Medbury River, adjoining Rochester, pop. 46,940; naval arsenal, shipbuilding, *map* B-325

Chatham, New Brunswick, port on Miramichi River 35 mi above Gulf of St Lawrence in agricultural district, lumber, pulp, fish; pop. 5223: *maps* C-73, 69

Chatham, Ontario, farming, fruit-growing and manufacturing center on Thames River 45 mi. e. of Detroit, Mich; pop. 21,218; canned goods, automobiles, machinery, flour, textiles *maps* C-72, *inset* C-68

Chatham Islands, group of islands 536 mi e of New Zealand to which they belong; 372 sq mi.; pop. 471; sheep grazing: N-227, *map* P-17

Châtillon-sur-Seine (*shä-tē-yôṅ'sür-sĕn*) France, town 125 mi. s e. of Paris on Seine River; pop. 3860; unsuccessful congress of Napoleon with Allies (1814).

'Châtiments, Les' (*lā chä-tē-mäṅ'*), lyrical satire by Victor Hugo H-441

Chatrian, Louis Gratien Charles Alexandre. *See in Index* Erckmann-Chatrian

Chattahoo'chee River, in Alabama and Georgia; 500 mi.; unites with Flint to form Apalachicola: *maps* A-114, 126–7, G-70, U-274

Chattanoo'ga, Tenn., railroad and industrial city in s.e. on Tennessee River; pop. 131,041: C-198–9, *maps* T-67, U-253, C-199, *picture* T-57
- bridge. *See in Index* Bridge, *table*
- cable railway, *picture* C-198

Chattanooga, battle of (Nov. 24–25, 1863) C-199, C-336, *map* C-199

Chattanooga, University of, at Chattanooga, Tenn.; Methodist; founded 1886; liberal arts, applied arts, fine arts; graduate studies.

Chattel, in law. *See in Index* Law, *table* of legal terms

Chattel mortgage B-52

Chatterji (*chä'tĕr-gē*), **Bankim Chandra** (1838–94), Indian novelist of Bengal I-66

Chatterton, Ruth (born 1893), actress, born New York City; stage debut 1909; entered motion pictures 1928; stage plays ('Daddy Long Legs', 'Mary Rose', 'The Changelings'); motion pictures ('The Royal Divorce', 'Dodsworth').

Chatterton, Thomas (1752–70), English poet and literary forger, precocious genius; wrote 'Rowley Poems', which he claimed were old manuscripts of 15th century; starving in a London garret, poisoned himself.

Chaucer (*chô'sẽr*), **Geoffrey** (1340?–1400), English poet C-200–4, *pictures* C-200–1
- 'Canterbury Tales' C-203–4: quoted E-376
- chief works and editions C-202, 204: Kelmscott Press edition, *picture* B-238
- description of squire, quoted K-56
- language E-374, C-202
- pension P-332
- place in English literature E-376, C-200
- tomb in Westminster Abbey C-202, *picture* L-304

Chaudet (*shō-dā'*), **Antoine Denis** (1763–1810), French sculptor and painter; favorite of Napoleon I; follower of Canova; combined classic form with romanticism; excelled in graceful subjects.

Chaudière (*shōd-yĕr'*) **Falls,** of Ottawa River O-428

Chauliac (*shō-lyäk'*), **Guy de** (died 1380?), French surgeon; doctor to three popes at Avignon; his 'Great Surgery' was manual for physicians for three centuries.

Chaulmoo'gra oil, fixed oil obtained from fruit of chaulmoogra tree of East Indies; has been used in treatment of leprosy.

Chaumonot (*shō-mô-nō'*), **Pierre Joseph** (1611–93), Jesuit missionary, born France; labored among Huron Indians in Canada for 40 years (1639–79), with brief period among Iroquois in upper New York (1655–58).

Chaumont (*shō-môṅ'*), France, manufacturing town 120 mi. s.e. Paris; pop. 15,068; treaty of Allies against Napoleon 1814; general headquarters A.E.F. in World War I: *map* E-425

Chauncey, Isaac (1772–1840), American commodore P-153

Chausson (*shōs-sôṅ*), **Ernest** (1855–99), composer, born Paris, France; pupil of Massenet and César Franck ('Le Roi Arthur' and 'Hélène', operas; 'Poème', for violin and orchestra).

Chautauqua (*sha-tô'kwa*), N.Y., village on Lake Chautauqua, about 58 mi. s.w. of Buffalo; pop. 500: C-205, *map* N-204

Chautauqua, Lake, in w. New York, 8 mi. from Lake Erie; 18 mi. long: *maps* N-196, 204

Chautauqua Institution, educational organization C-205

Chautauqua muskellunge P-256

Chautauqua University C-205

Chautemps (*shō-täṅ'*), **Camille** (born 1885), French statesman, radical socialist leader, born Paris, France; premier 1930, 1933–34, 1937–38; in U. S. after 1940.

Chauveau, Pierre Joseph Olivier (1820–90), Canadian statesman, lawyer, and author, born Quebec; prime minister of Quebec 1867–73; author of poems, novels, and essays.

Chauvinism (*shō'vin-izm*), exaggerated patriotism or "jingoism"; derived from name of a French soldier, Nicholas Chauvin, who was passionately devoted to Napoleon.

Chaux de Fonds (*shō dŭ fôṅ*), **La,** Switzerland, town 30 mi. n.w. of Bern in Jura Valley; pop. 33,154; watches and clocks: *map* S-475

Chavannes, Puvis de, French painter. *See in Index* Puvis de Chavannes

Chavez (*chä'väs*), **Carlos** (born 1899), Mexican composer and conductor, first in his country to attain wide recognition; founder and director Symphony Orchestra of Mexico 1928–49; director National Conservatory of Music; a modernist, he expresses vital national spirit ('H. P.'; 'Sinfonia India'): M-204

Chayote (*cha-yō'tä*), also called **vegetable pear,** a vine belonging to the gourd and melon family; also its edible pear-shaped fruits, white or

ü=French u German ü *gem* *go* *thin* *then* ṅ=*French nasal* (Jean) zh=French j (z in azure) ḳ=German guttural ch

WORLD'S LARGEST CITIES

		Population
1.	Greater London*	8,346,137
2.	New York†	7,891,957
3.	Tokyo	5,385,071
4.	Moscow	4,500,000
5.	Shanghai	4,300,630
6.	Chicago	3,620,962
7.	Berlin	3,350,785
8.	Leningrad	3,300,000
9.	Buenos Aires	2,982,580
10.	Bombay	2,839,270
11.	Jakarta	2,800,000
12.	Paris	2,691,473

*See population and area of the "Three Londons" L-290.
†New York-Northeastern New Jersey standard metropolitan area, 12,911,994.

wood lumber cotton and cotton products railroad shops map M 302, I 253

Clark's nutcracker or **Clark's crow** a bird of the crow family (Corvidae) in the w. U.S. length about 12½ in. plumage whitish gray except for sooty brown wings and inner *tail feathers*

Clarkson College of Technology at Potsdam N. Y. for men chartered 1896 business administration civil chemical electrical and mechanical engineering chemistry physics graduate studies

Clarksville Tenn city 40 mi n.w. of Nashville pop. 16,246 settled in 1784 tobacco markets and warehouses machine works Austin Peay State College map T 86 I 253

Clark University at Worcester Mass. founded 1887 opened 1889 arts and sciences business administration geography graduate division

Class in biological classification B 152

Classical literature (Greek and Latin) G 208–12 L–129–32 *See also in Index* Greek literature Latin literature
children's literature place in I 273–4
influence in Renaissance R 103–4
preservation B 236–7

Classic architecture term applied to Greek and Roman styles or those derived from them during the Renaissance *See also in Index* Greek architecture Renaissance architecture Roman architecture

Classic design in furniture I 178 *picture* I 182

Classification in natural sciences
animals A 251–2 B 152 B 178 I 225 L–254 *picture* A 251 *Reference Outline* Z 364
insects I 160–160a
man A 264 R 21–4 *pictures* P 21–3 *Reference Outline* P 23–4
minerals M 261
plants P 288–90 L–225 *color picture* P 289 *Reference Outline* P 264–5
nomenclature and principles B 152 L–254–5
rocks G 60–2 M 266
stars S 372

Classification of books
Dewey decimal system L 204–6

Classification exception rates for freight R 68

Classified rates for freight R 68

Class magazines M 29

Classroom libraries L 195

Class struggle in Marxian theory M 105 C 426

Clastic rocks R 169

Claude (*klōd*) **Georges** (born 1870) French scientist inventor of process for liquefying air and other gases made ammonia out of atmosphere invented neon light devised method of utilizing for power difference in temperature between the waters at the depths and the surface of tropical seas

Claudel (*klō dĕl*) **Paul Louis Charles** (1868–1955) French poet dramatist and diplomat held diplomatic posts in China Japan Brazil Germany and Denmark ambassador to United States 1927 33 writings are mystical and reflect deep religious faith ('The City' 'The Hostage' 'The Tidings Brought to Mary' plays 'Three Poems of the War') F 289

Claude Lorrain (*lō rĕn*) real name Claude Gelée or Gellée (*zh lā*) (1600–1682) French landscape painter born Lorraine influenced by Italian Renaissance and classical art

Claudian aqueduct famous Roman aqueduct begun by Caligula A.D. 38 completed by Claudius A.D. 52 was 45 miles long for 7 miles out of Rome ran on line of arches ruins of which still remain

Claudius I (10 B.C.–A.D. 54) Roman emperor nephew of Tiberius
Colonia Agrippina C 386
conquers Britain P 357
place in Roman history R 187
poisoned by Agrippina N 110

Claudius Appius Roman decemvir 451 449 B.C. whose attempt to enslave Virginia beautiful daughter of a plebeian centurion caused revolution and abolition of the decemvirate story told in Macaulay's 'Virginius and Virginia' in the Lays of Ancient Rome

Claudius Caecus Appius Roman patrician chosen to censorship 312 B.C. builder of Appian Way and aqueduct R 197
legs destiny of Pyrrhus *picture* I 187

Clauses in grammar S 101 100

Clausewitz (*klou zĕ vits*) **Karl von** (1780 1831) Prussian general and military writer whose philosophy of warfare became not only in Germany but in many other countries a basis of military studies

Clausius (*klou zē ŏs*) **Rudolf J. E.** (1822–88) German physicist one of founders of modern science of thermodynamics

Claustrophobia (*klâs trō fō bĭ a*) abnormal fear of closed places

Clavaria a group of fungi M 457 *color picture* M 456

Claverhouse (*klāv ĕr- or klā vĕr*) **John Graham of** (1649?–89) **Viscount Dundee** persecutor of Scottish Covenanters and a Jacobite rebel 'bonny Dundee' to Jacobites and bloody Claverse to Covenanters

Clavichord forerunner of piano P 247 B 19 *pictures* P 249

Clavichord, The Well tempered composition by Bach B 10 M 461–2

Clavicle the collarbone which connects the breastbone and shoulder blade S 192 *picture* S 192 *color picture* P 239

Clavier (*klā vĭ ĕr*) a keyboard term sometimes applied to any instrument with a keyboard such as the piano organ clavichord and harmonium
practice clavier P 250

Clavilux a "color organ" C 400

Claw of animals developed from epidermis S 193

Claw-and-ball foot in furniture I 178

Claxton Philander Priestley (born 1862) educator born Bedford County Tenn U S commissioner of education 1911 21 superintendent of schools Tulsa Okla 1923 president 1930–46 then president emeritus of Austin Peay Normal School (now Austin Peay State College) Clarksville Tenn originates Education Week F 58

Clay Henry (1777 1852) American orator and political leader C 341–2 *picture* C 341
cattle brought to U S A 63
Compromise of 1850 C 429 30
Hall of Fame *table* H 249
Missouri Compromise M 325 C 342
opposes Soo Canal M 216
Statuary Hall *See in Index* Statuary Hall (Kentucky) *table*
tariff policy T 18
War of 1812 W 12 C 341 *picture* M 23

Clay Lucius D (born 1897) Army officer born Marietta Ga made assistant chief of staff Material Service of Supply 1942 deputy to Dwight Eisenhower 1945 deputy U S military governor in Germany 1946 European theater commander of U S forces and U S military governor for Germany 1947 49

Clay C 339–41 *pictures* C 340 *See also in Index* Brick Porcelain and chinaware Pottery Tile *also* kinds of clay by name
aluminum in A 182
brickmaking B 302 C 341
cementmaking C 165 166
formation C 340
fuller's earth F 315
kaolin in M 266
kinds C 340–1
pottery clays C 341 P 399 400
soils S 251
tablets ancient books *See in Index* Clay tablets
tile B 305
uses *pictures* C 340 taxidermy *picture* T 28
water factor in making W 60

Clayborne William *See in Index* Claiborne

Claymore two edged broadsword formerly used by the Scottish Highlanders name inaccurately used for single-edged basket hilted sword worn by Highland regiments of British army

Clay prism, hollow polygon of clay with six seven or eight sides used by Babylonians to record chief events *picture* B 7

Clay tablets in ancient writing B 6a B 231 H 386–6 N 239 *pictures* B 6a L 181

Clayton Henry de Lamar (1857 1929) jurist born Barbour County Ala member Congress 1897 1914 author Clayton Act

Clayton John M (1796 1856) born Dagsboro Del U S senator 1829 37 1845–49 1853 56 secretary of state under Taylor T 28 *See also in Index* Clayton Bulwer Treaty Statuary Hall (Delaware) *table*

Clayton Mo residential suburb of St Louis pop 16 035 *map* *inset* M 319

Clayton Act (1914) M 360

Clayton Bulwer Treaty between U S and Great Britain (1850) providing neither country should have exclusive control over any interoceanic canal in Central America T 28 P 54
Hay Pauncefote Treaty abrogates M 20

Clean culture in agriculture
corn C 484

Cleaning dry L–136

Cleaning materials H 411 *Reference Outline* H 414

Cleanliness
baby care B 2 3 4
health requirements H 304 306

Clearance *See in Index* Aviation *table* of terms

Clear flour F 167

Clear Grits nickname of Canadian Liberal Party C 99

Clearing agreements in foreign trade I 198

Clearinghouse in banking B 60
certificates issued R 224
international trade *chart* I 195

Clearwater Fla city 20 mi w. of Tampa pop 15 581 incorporated in 1891 tourist trade citrus packing and canning *map* F 158

Clearwater Mountains in n.e. Idaho I 13 *map* I 14

cultural and dairying district pop 13,806 extensive iron and steel works textile mills map P 133

Coati fur-bearing animal of the genus Nasua ranges from Mexico to Paraguay long upturned white snout long soft brown fur with reddish or gray tint habits like those of small *tree-climbing cats* eats birds lizards insects

Coat of arms H 341
Shakespeare's S 120

Coat of mail a garment made of chain mail or scale mail A 376-7 *picture* F 60

Coat of mail shell of mollusks S 139; M 334

"Coat of many colors" gift of Jacob to Joseph in Bible (Gen xxxvii 3) J 363

Coats Land in Antarctica extends w from Queen Maud Land forming e shore of Weddell Sea discovered and named 1904 by *Scotia* Expedition *maps* A 259, W 204

Coatsworth Elizabeth J (Mrs Henry Beston) (born 1893) poet and writer for children born Buffalo N Y travels in Europe China Japan and Mexico gave rich background for her work (poems Night and the Cat children's books The Cat Who Went to Heaven awarded Newbery medal 1931 Away Goes Sally Door to the North)
illustration *picture* S 410

Coatzacoalcos Mexico *See in Index* Puerto México

Coaxial (kō ăk si ăl) **cable** T 41 T 44-5
telephone T 45
television T 54a T 45 *diagram* T 54a

Cob male swan S 459

Cobaea (kō bē a) or **cathedral bells** a genus of annual vines of the phlox family native to tropical America Leaves with climbing tendrils ending each leaf cluster flowers bell shaped violet or yellow green grows to 20 feet

Cobalt city in Ontario Canada 245 mi n w of Ottawa minerals in vicinity include silver cobalt and nickel pop 2230 *maps* C 69 72

Cobalt a metallic element C 372 *tables* P 151 C 214
alloys A 173 174
electrochemical activity E 315
invisible ink I 151

Cobaltite (kō bôl tīt) an ore compound of cobalt arsenic and sulfur C 372

Cobán (kō bän) city in central Guatemala pop 6854 trade in coffee cocoa vanilla sugar cane *map* C 172

Cobb Howell (1815–68) political leader born Cherry Hill Ga governor of Georgia 1851-53 secretary of treasury 1857-60 president of Confederate Congress 1861-62
presides over Confederate Congress *picture* C 433a

Cobb Irvin S (1876–1944) short story writer humorist and dramatist born Paducah Ky began newspaper work when very young as reporter and contributor to comic weeklies at 19 editor of Paducah Daily News correspondent in Europe 1914-15 1917-18 stories of Kentucky life humorous treatment of foibles of the day (Old Judge Priest Speaking of Operations— Ladies and Gentlemen Incredible Truth Exit Laughing autobiography)

Cobb John Rhodes (1899–1952) English fur broker and automobile racer born Esher England became first man to travel 400 m p h on land in 1947 at Bonneville Utah on one of his runs which averaged 394.196 m p h to set world land speed record killed in jet propelled hydroplane in attempt to break world motorboat record *picture* A 529

Cobb Tyrus Raymond (Ty) (born 1886) baseball player born Banks County Ga *picture* B 65 *See also in Index* Baseball Hall of Fame *table*

Cobbett William (1763–1835) (pseudonym Peter Porcupine) English journalist and reformer born Farnham England edited *Cobbett's Political Register* 1802-35 member of Parliament 1832-35 (Rural Rides) F 369c

Cobbler fish or **thread fish** (*Alectis crinitus*) a fish whose dorsal and anal fins have some rays longer than the body when young wearing shorter with age range West Indies to Cape Cod

Cobden Richard (1804–65) English liberal statesman and economist strong advocate of free trade peace arbitration and disarmament in parliament 1841-57 leader in Anti Corn Law league in 1839 and worked against corn laws until their repeal in 1846 concluded commercial treaty with France 1860 author of political leaflets

Cobden-Sanderson Thomas J (1840–1922) English bookbinding designer B 241
influenced by William Morris T 230

Cobh formerly **Queenstown** seaport in s Ireland pop 5711 C 372 *map* L 325

Cobham Sir Alan J (born 1894) British aviator air pilot in World War I active in stimulating popular interest in aviation member De Havilland Aircraft Co flew London-*Rangoon* and back London-Cape Town and back England-*Australia* and back wrote Skyways and My Flight to the Cape and Back

Cobia *See in Index* Sergeant fish

Coblenz (kō blĕnts) or **Koblenz** Germany city at confluence of Rhine and Moselle pop 66,444 Moselle wine headquarters of Allies after World War I *maps* G 88 E 425
pontoon bridge *picture* B 310

Cobourg (kō bûrg) Ontario Canada all year and summer resort on Lake Ontario about 67 mi e of Toronto pop 7470 *maps* C 72 inset C 68

Cobra (kō bra) venomous snake of India and Africa C 372-3 S 207
pictures C 372 S 207 Z 359
distinguished from vipers V 476-7
mongoose battle with *picture* M 346
poison action of S 208

Coburg or **Koburg** (kō bŭrg) Germany manufacturing town in Bavaria formerly cap of duchy of Saxe-Coburg Gotha pop 44,999 interesting old castle and other medieval remains *map* E 425

Cobweb S 343-4 *pictures* S 342-3

Coca (kō ka) cocaine yielding shrub of flax family P 162 N 13, *picture* S 250

Cocaine (kō kān) a white bitter alkaloid made from coca leaves narcotic and local anesthetic N 13 A 246-7
synthetic substitute for B 147
Peru produces P 162 164
poisoning treatment P 341

Coccus (kŏk ŭs) plural **cocci** a sphere shaped bacterium *picture* B 12

Coccus cacti cochineal insects C 373

Coccyx (kŏk siks) the small bone in the adult skeleton forming the tip of the spinal column below the sacrum S 191 *picture* S 192

Cochabamba (kō chä bäm bä) Bolivia a manufacturing city and trade center of rich grain district in west pop 80,795 *map* S 252

Cochin (kō chĭn also kŏch ĭn) former princely state in s India now part of Travancore-Cochin state

Cochin a breed of poultry P 402b, *picture* P 402a

Cochin China former French colony in s Indo-China after 1949 part of Viet Nam republic over 26,000 sq mi pop 4,615,000 cap Saigon I 122-3 *map* I 123

Cochineal (kŏch i nēl) red dye obtained from scale insects C 373
ink coloring I 150
insect pictures S 54

Cochise (kō chēs) (1815?–74) Apache (Chiricahua) Indian chief leader of white villages in Arizona 1861-71 to avenge death of friends at hands of American soldiers allied with chief Mangas Coloradas *he escaped after defeat by Gen* Crook fought troops at Apache Pass died on Arizona reservation

Cochise culture of prehistoric North American Indians named for Cochise County Ariz (named for Cochise Indian *chief*) *periods* Sulphur Spring 13,000-8000 B C Chiricahua *8000-3000 B C* San Pedro 3000-500 B C had no farming *no pottery* or permanent homes I 108f

Cochiti (kō che te) a pueblo 23 mi s w of Santa Fe N M on the Rio Grande Cochiti people belong to the Keresan language group of Pueblo Indians *map* N 178

Cochlea (kŏk lē a) part of the ear E 170-2

Cochran (kŏk ran) **Jacqueline** (Mrs Floyd Bostwick Odlum) aviator and cosmetic manufacturer born Pensacola Fla awarded Distinguished Service Medal for work with women pilots in World War II won Harmon trophy for world's outstanding woman flier of 1937-49 1953 and 1954 in *May 1953 set* new world jet speed record for women (652 mph) *and became* first woman to fly faster than sound autobiography The Stars at Noon

Cochran Robert Vermont patriot V 461

Cockaigne (kŏk ān) **Land of** an imaginary land of luxury joy and delightful feasts subject of a *13th-century* satirical poem

Cockatoo (kŏk a tōō) crested parrot like bird P 93 *color pictures* B 176 P 92

Cockburn (kō bērn) **Land** name given to a portion of Baffin Island in Canadian Arctic

Cockchafer *June bug* or *May beetle* J 364 M 52

Cockcroft Sir John Douglas (born 1897) English physicist professor at Cambridge University 1939-46 headed air defense research ministry of supply 1941-44 and Canadian atomic energy research 1944-46 director British Atomic Energy *Research* Establishment since 1946 helped devise ion accelerator A 462a

Cockerell Douglas Bennett (1870–1945) English bookbinder and type designer pupil of Cobden-Sanderson *after* whose retirement Cockerell was generally recognized as leading English binder (Bookbinding and the Care of Books)

water power from Mohawk Falls large cotton and knitting mills rolling mills automobile parts tractors *map* N 205

Co-hong Chinese merchants guild C 279

Coho salmon or silver salmon S 28

Cohosh black *See in Index* Snake root

Coign or shield in geology G 54 *diagram* G 54

Coil electric
- alternating current affected by E 306
- radio R 34 39 choke R 39

Coil magnetic E 303

Coimbra (*kō-ēm brä*) Portugal historical city 65 mi s of Porto pop 41 977 *map* F 416
- University of Portugal P 380

Coins and coinage M 335–40 M 292 3 *pictures* M 335 338 340 I r a list of coins of U S *see table* in this page
- alloys gold G 132–3 silver A 174
- ancient M 292 M 336 H 386
- China C 273
- collecting M 340 books about H 389
- counterfeiting C 498
- embossing process E 337
- first made by Lydians S 188
- gold amount used G 134 legal standards and value G 133 M 339–40
- milled edges M 337
- minting process M 292
- nickel N 234
- proof coins M 340
- silver amount used S 188
- standard money M 337
- token money M 337 *picture* M 336
- United States adopts decimal system J 332b
- units originally names of weights M 336

Coir coconut husk fiber C 374 B 330 *table* F 63

Coke Sir Edward (1552–1634) English jurist speaker of House of Commons 1593 chief justice of King's bench 1613 defender of liberal measures ('Coke upon Littleton' or the First Institute authoritative treatise on English law)

Coke Thomas (1747–1814) first bishop of Methodist Episcopal church born Brecon Wales superintendent for America of Methodist Society active missionary

Coke C 380 F 313
- by products C 380 F 55
- gas manufacture produced in G 30 used in G 31
- iron smelting I 236 238 239 I 132 *diagram* I 236
- petroleum coke C 380 *charts* P 175 176–7

Coker College at Hartsville S C for women founded 1908 arts and sciences

Cola nut the seed of a large tree (*Cola acuminata*) of the sterculia family native to Africa and cultivated elsewhere in tropics also called kola or goora nut
- contains caffeine T 30
- drinks made from P 301

Colbert (*kôl bĕr*) Jean Baptiste (1619 83) France's greatest financial statesman C 390–1
- founds French Academy in Rome R 193

Colborne Sir John Baron Seaton (1778 1863) English soldier and administrator lieutenant governor of Upper Canada 1830 36

Colburn Irving Wightman (1861–1917) manufacturer and inventor born Fitchburg Mass G 125 121 2

Colby Bainbridge (1869 1950) lawyer and political leader born St Louis Mo one of founders of Progressive (Bull Moose) party secretary of state 1920–21

Colby College at Waterville Me co-ordinate divisions for men and women chartered 1813

Colchester England port on Colne River 52 mi n e of London pop 57 436 Roman ruins oyster fisheries trade in grain *map* B 325

Colchicine extract of colchicum influences plant growth P 307

COINS OF THE UNITED STATES

Gold Coins

Double eagle $20 eagle $10 half eagle $5 quarter-eagle $2 50 $3 piece coined 1853–90 $1 piece (coined 1849–90 A few $50 pieces were issued in 1915 for the Panama Pacific Exposition

These coins based on the former gold valuation of $20 67 a fine ounce are no longer minted and their possession (except by bona fide collectors and dealers) and circulation were prohibited by law in 1933

Silver Coins

Dollar (412 5 grains fine silver)
Half dollar (legal tender to $10)
Quarter-dollar (legal tender to $10)
Dime (legal tender to $10)
Twenty-cent piece (coined 1875–78)
Half-dime coined 1792 1873)
Three-cent piece (coined 1851 73)
Trade dollar coined 1873–87 420 grains fine silver limited legal tender)

Nickel Copper Bronze Coins

*Five-cent piece (nickel 77 16 grains) first coined 1866 legal tender to 25 cents
†Cent (bronze 48 grains coined since 1864)
Three-cent piece nickel coined 1865–90)
Two-cent piece (bronze coined 1864–73)
Cent (copper at first 264 grains later 168 grains coined 1787 1857)
Cent (nickel coined 1857–64)
Half-cent (copper coined 1792 1857)

*Standard alloy—75% copper 25% nickel (Manufacture of this alloy temporarily discontinued May 1942 Five-cent piece coined from October 1942 to December 31 1945 was an alloy of 56% copper 35% silver and 9% manganese Coinage of standard alloy resumed January 1946)

†Standard alloy—95% copper 5% tin and zinc Zinc-coated steel cent was produced from February 1943 to December 1943 Weighed 42 5 grains From January 1944 to December 1946 the cent was an alloy of 95% copper and 5% zinc Weighed 48 grains Coinage of standard alloy resumed January 1947)

Colchicum a genus of plants of lily family native to Europe and Asia some flowers resemble the crocus some species bloom in fall leaves appear in spring also called meadow saffron and autumn crocus corm used in medicine P 307

Colchis (*kŏl kĭs*) district in Caucasia at e extremity of Black Sea in mythology land of Golden Fleece A 338 C 156

Colcord Lincoln (Ross) (1883 1947) American author born at sea off Cape Horn spent boyhood on voyages with father wrote sea stories ('The Drifting Diamond' 'An Instrument of the Gods')

Cold lack of heat
- absolute zero meaning H 319
- how sensed T 158 159
- lowest temperature recorded C 350
- meaning of H 317
- produced by refrigeration R 93–4

Cold common or coryza catarrhal condition generally of respiratory tract D 104
- avoidance and care H 305 F 98
- mode of infection D 102

Cold deserts D 73b

Cold frame a glass covered frame to protect young plants G 13–14 *picture* F 36 *table* G 16

Cold Harbor Va place 9 mi n e of Richmond battle of Gaines Mill 1862 Grant defeated by Lee 1864 with great loss *map* C 335

Cold light E 311 P 208

Cold pack a method of canning foods F 222

Cold rubber R 246

Cold storage preserving foodstuffs by refrigeration C 381 *See also in Index* Refrigeration
- distinguished from quick freezing F 222
- eggs and poultry P 402
- fruits F 303–4
- meats M 154 *picture* M 156a

Cold storage locker C 381 F 223 R 98 *picture* F 222

Coldstream Scotland historic border village on Tweed River near famous ford pop 1294 celebrated Coldstream Guards raised by General Monk 1659 *map* B 324

Cold war (Russia and China against the West) E 438 P 292–292a, 292b E 289d f

Cold wave causes of W 80

Cole George Douglas Howard (born 1889) English economist and writer born Cambridge England professor of political theory Oxford since 1944 chairman Fabian Society 1939 46 and since 1948 ('The British People 1746 1946' with Raymond Postgate 'World in Transition') also wrote detective stories with wife **Margaret Isabel (Postgate) Cole** (born 1893)

Cole King a mythical king of Britain said to have reigned in 3d century subject of nursery rhyme

Cole Rossetter Gleason (1866–1952) composer and teacher of music born near Clyde Mich compositions for organ piano chorus orchestra symphonic music and operas ('The Passing of Summer' 'Hiawatha's Wooing')

Cole Thomas (1801 48) American painter born England began career as wood engraver known chiefly for his landscapes of New York State and New England a leader in Hudson River School

Cole Timothy (1852–1931) American wood engraver greatest of his day born London England masterly interpretations of Dutch Italian Spanish and English old masters engravings much used in magazine and newspaper illustration

Coleman Arthur P (1852–1939) Canadian geologist and educator professor geology University of Toronto explored and mapped sections of Rockies and other parts of Canada

Colemanite a mineral borate of lime yielding borax M 265 B 252

Coleoptera (*kŏl e op tĕr ȧ*) the beetle order of insects with front wings usually horny and chewing mouth parts B 104 I 160a *See also in Index* Beetles Weevil

Colepeper Thomas Lord *See in Index* Culpeper Thomas Lord

Coleridge Hartley (1796–1849) English writer eldest son of Samuel Taylor Coleridge wrote scholarly literary criticism excellent sonnets and 'Prometheus' an unfinished lyric drama

Coleridge Samuel Taylor (1772–1834) one of English Lake Poets C 381 2 E 379
- anecdote about talkativeness C 458
- book annotations B 247

Key: cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; ice, bĭt; rōw, wȯn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn; out;

AREA OF CONTINENTS

Name			Area in Sq Mi.
Africa			11,600,000
Antarctica between	5,000,000	and	6,000,000
Asia			17,200,000
Australia			2,948,366
Europe			3,900,000
North America			9,400,000
South America between	7,200,000	and	7,310,800

NATIONAL PRESIDENTIAL CONVENTIONS

Year	Party	Place	Nominee
1900	R	Philadelphia	McKinley
	D	Kansas City	Bryan
1904	R	Chicago	Roosevelt, T
	D	St Louis	Parker
1908	R	Chicago	Taft
	D	Denver	Bryan
1912	R	Chicago	Taft
	D	Baltimore	Wilson
1916	R	Chicago	Hughes
	D	St. Louis	Wilson
1920	R	Chicago	Harding
	D	San Francisco	Cox
1924	R	Cleveland	Coolidge
	D	New York	Davis
1928	R	Kansas City	Hoover
	D	Houston	Smith
1932	R	Chicago	Hoover
	D	Chicago	Roosevelt, F D
1936	R	Cleveland	Landon
	D	Philadelphia	Roosevelt F D
1940	R	Philadelphia	Willkie
	D	Chicago	Roosevelt, F D
1944	R	Chicago	Dewey
	D	Chicago	Roosevelt F D
1948	R	Philadelphia	Dewey
	D	Philadelphia	Truman
1952	R	Chicago	Eisenhower
	D	Chicago	Stevenson

argillacea (family *Noctuidae*); eats leaves of cotton plant; destroyed by dusting with Paris green
moth, egg, *picture* E-269
Cottony-cushion scale S-53
Cottony-maple scale S-54
Cottrell, Frederick Gardner (1877–1948), chemist and inventor, born Oakland, Calif.; invented Cottrell precipitator, reduced cost of extracting helium
Cottrell precipitator, a device designed to reduce smoke pollution and recover industrial wastes, consists of an electrically charged pipe through which runs a wire of opposite charge, dust and particles in gases are deposited on walls of pipe
Cotuit (*kō-to'it*) **oyster** O-437
Cotula (*kŏt'ū-la*), a genus of low growing annual or perennial plants of the composite family, suitable for rock gardens; flowers yellow, buttonlike; *at end of stiff stems*
Coty (*kô-tē'*), **René** (**Jules Gustave**) (born 1882), French political leader (Independent Republican) and lawyer, born Le Havre, France; served as member of Parliament 1923–53 except while France was occupied; president of France 1954–.
Cotyledon (*kŏt-ĭ-lē'don*), a seed leaf S-98, *picture* S-97
bean, germination of, *picture* B-84
Couch'ant, in heraldry H-341
Couchet (*ko-chĕ'*), **Jans,** maker of harpsichords *picture* P-249
Couch grass Q-1, *picture* Q-1
Coué (*ko-ā'*), (**Philippe**) **Émile** (1857–1926), French psychotherapeutist, taught health could be maintained, disease overcome by autosuggestion, his formula "Every day in every way I am getting better and better" became famous
Coues (*kouz*), **Elliott** (1842–99), American naturalist, authority on birds ('Key to North American Birds'; 'Birds of the Northwest').
Cougar (*ko'gar*), *mountain lion,* or puma P-435–6, *picture* P-436, *color picture* N-260
ecological relation to deer E-216–17, N-63
purring C-135*b*
Coughing, explosive and noisy expulsion of air from the lungs through the mouth; caused by some irritation of the linings of the respiratory passages; cough is preceded by a short inspiration which closes the glottis; noise of cough caused by opening of the glottis
reflex action R-90
Coulee Dam, in state of Washington. *See in Index* Grand Coulee Dam
Coulee Dam National Recreation Area N-38*d*, *map* N-18
Coulomb (*ko-lôṅ'*), **Charles A.** (1736–1806), French physicist; founded mathematical theory of electric and magnetic action; practical unit of electric quantity named for him
Coulomb's law E-308
Coulomb, unit of electrical quantity E-298
Coulter (*kōl'tẽr*), **John Merle** (1851–1928), American botanist, born Ningpo, China; son of missionaries; botanist with the U. S. Geological Survey in Rocky Mts. (1872–73) which resulted in development of Yellowstone National Park; taught in several colleges, including University of Chicago (1896–1925); was president of Lake Forest and Indiana universities; adviser, Boyce Thompson Institute of Plant Research, 1925–28; author of many textbooks and other works on botany.
Coumarin (*ko'ma-rin*), or **cumarin,** crystalline substance, from sweet clover, tonka bean, and other plants; used in perfumes and flavors.
prepared synthetically C-371
Council, in American cities M-451
Council, Order in, Great Britain. *See in Index* Order in Council
Council, Security, of United Nations. *See in Index* Security Council
Council Bluffs, Iowa, city on Missouri River opposite Omaha, Neb.; pop. 45,429; railroad shops; playground equipment, railroad car wheels, truck bodies; named from council of Lewis and Clark with Indians (1804) *maps* I-214, U-253
East Omaha Bridge. *See in Index* Bridge, *table*
Council Fire, of Camp Fire Girls, *picture* C-54
Council-manager government, in American cities M-451
Toledo T-145–6
Council of Blood, formed 1567 by Duke of Alva to support Spanish claim in Netherlands N-121
Council of Clermont C-519
Council of Economic Advisers, U. S. U-358
Council of Europe, a "parliament" for unification of w. Europe; first meeting 1949 in Strasbourg, France, permanent capital; consultative assembly, made up of representatives of national parliaments, committee of ministers (executive body) made up of foreign ministers of the member nations: *table* N-16*a*
Council of Foreign Ministers, formed by Potsdam agreement, 1945, to draft peace treaties; members: China, France, Great Britain, Russia, United States.
Council of League of Nations L-142
Council of Ministers, in Russian government R-282–3
Council of National Defense, U. S. W-234, 235
Council of Republic, France F-266
Council of Ten (1310–1797), tribunal of 10, afterward 17, which governed republic of Venice V-446
Council of Trent R-93, T-185, P-277
promotes adoption of surnames N-2*a*
Councils, church. *See in Index* Church councils
Count, title of nobility D-40
Counterelectromotive force (counter e.m.f.) E-305
Coun'terfeiting, making imitations of money C-498
Counterpoint, in music M-468*a*, 460. *See also in Index* Music, *table* of musical terms and forms
Counter Reformation, in Roman Catholic church R-93
Loyola L-339, R-93
Pius IV and Pius V P-277
Countershading, in protective coloration P-420–1
Countersign, secret word or phrase without which no one may pass a guard or sentry.
Counterweight, a weight used for counterbalancing
in elevator E-328, *picture* E-328
Countess, in British nobility wife or widow of an earl, also a woman possessing an earldom; in European nobility wife or widow of a count, also, in some countries, the daughter of a duke, a marquis, or a count.
Counting board, *picture* N-312*b*
'Count of Monte Cristo', novel by Dumas; story of Edmond Dantès, sailor, who is imprisoned on false charge, escapes from prison, gains buried treasure, and returns as the mysterious Count of Monte Cristo to dazzle Paris
Château d'If M-102
County, political division C-498
England E-356
health work H-308, C-454*a*
name, origin of C-498
parks and playgrounds P-86*a*
police P-355*b*
unincorporated areas governed by M-450
County agent. *See in Index* County agricultural agent
County agricultural agent, a trained agriculturist in the Co-operative extension service. Works through educational programs for better farming methods; aids in soil conservation, insect control, and eradication of plant and animal diseases. County agents employed in 3062 counties in 1954: F-31–2. *See also in Index* Federal Extension Service
County attorney. *See in Index* State's attorney
County borough, in England E-356
County council, in England E-356
County fairs, U. S. F-13, F-30, *pictures* F-30*a*, *b*
County home demonstration agent. *See in Index* Home demonstration agent
County libraries L-189–92
County manager system C-498
Coup d'état (*ko dā-tā'*), bold or brilliant stroke of statesmanship, usually unconstitutional and often accompanied with violence; a famous example is that by which Louis Napoleon made himself emperor: N-11
Coupé (*ko-pā'*, popular pronunciation *kop*), automobile A-502
Couperin (*kop-răṅ'*), **François** (1668–1733), French composer and court musician; master of music for clavecin, a type of harpsichord.
Cou'perus, Louis (1863–1923), Dutch novelist, whose stories of human tragedies have an Aeschylean inevitability ('The Small Souls'; 'The Twilight of the Soul'; 'Old People and the Things that Pass').
Couplet, in poetry P-336
heroic P-336; Dryden uses D-157; Pope P-369, E-378*a*
Coupling, in radio R-37, 40
Couplings, railroad cars R-64–5, *picture* R-63
Cou'pon (*ko'pŏn*), a dated certificate, attached to bond or other commercial instrument; represents interest due; should be detached and presented independently for payment.
Courage
Carnegie hero fund C-124
decorations for D-38–40, *picture* D-39, *color picture* D-41
Courante (*ku-rănt'*), a court dance popular in 16th and 17th centuries; of French or Italian origin; name from French *courir* ("to run"); Italian type rapid with running steps, French slower with complex rhythms; in music, part of suite following allemande. *See also in Index* Allemande; Suite
Cour'bash, or **kurbash,** a whip of heavy hide; term also applied to forced labor under the lash; outlawed in Egypt under British rule.
Courbet (*kor-bĕ'*), **Gustave** (1819–77), French painter, leader of school of realism; vigorous color in figures and landscape ('Burial at Ornans'; 'Combat of the Stags').
Courcelle, Rémy, Sieur de (died 1698), governor of New France (Canada) 1665–72; led a successful expedition against Mohawks and brought about peace with Iroquois.
Coureurs de bois (*ko-rûr' dŭ bwä*) ("runners of the woods"), French Canadians of early days who explored remote regions, engaged in hunting and trading with Indians.

often lived and dressed like the natives
fur trade F 324
Courland a Baltic district of 10 435 sq mi formerly province of Czarist Russia now part of Latvia L-135
Courlander Harold (born 1908) folk lorist and author born Indiana traveled to Haiti Cuba West Africa, Ethiopia and Iran in U S service World War II in Eritrea and India has collected in his books for children folk tales of West Africa ('The Cow tail Switch' with George Herzog) of Ethiopia ('The Fire on the Mountain' with Wolf Leslau) and of Indonesia ('Kantchil's Lime Pit')
Course in brick masonry B 304
Course in navigation N 72
Court law *See in Index* Courts of Justice
Court cupboard I 177 *picture* I 177
Courteline (*kort lēn*) **Georges** (1860–1929) French author called Prince of Humorists wrote of "small men and their small lives"
Courtesy E 404–11 W 24
Courthope (*kôrt ōp*) **William John** (1842 1917) English literary critic born near Lewes England professor of poetry Oxford 1895–1901 (Addison for English Men of Letters series A History of *English Poetry* 6 vols)
Court of Arbitration *See in Index Permanent Court of Arbitration*
Court of International Justice Permanent. *See in Index* Permanent Court of International Justice
Court of Justice International II 242
Court of Lions Alhambra *picture* S 321
Court of Myrtles Alhambra A 167
Courtois (*kor twä*) **Bernard** (1777 1838) French chemist, discoverer of iodine I 204d
Court plaster sticking plaster made of silk gummed with a healing mixture named from use by ladies of the court as beauty plasters
Courtrai (*kor trē*) Flemish Kortrijk Belgium fortified town on Lys River 45 mi w of Brussels pop 39 813 fine linen and lace history dates from 7th century battle of Spurs (1302) French conquered by Flemings pop 200 000 in Middle Ages battle 1918 in Ypres campaign
Courtship of animals. *See in Index* Animals *subhead* courtship *also* Birds *subhead* courtship and mating
'Courtship of Miles Standish' The poem by Longfellow S 369 L-310 *picture* A 229a
Courts martial military or naval courts of justice C 500
Courts of justice C 499–502 *pictures* C 499–501 *See also in Index* Supreme Court U S
arbitration courts A 294
courts martial C 500
England C 500 1 common law E 361 L-139 reforms of Henry II H 335 6 F 361 Star Chamber H 337 S 382
jury trials J 365–7
juvenile courts J 368
medieval Court of Piepowder" F 12
"people's court in China *picture* C 284
United States C 499
established by Constitution U 352 345
federal courts C 499 500 *pictures* C 499 W 31 salaries *table* U 357
pioneer days P 266
power to review acts of federal agencies F 50 I 193
state courts C 499 500 S 385 *picture* C 500
Court tennis early lawn tennis T 72
Couse E. Irving (1866–1936) painter born Saginaw Mich painted Taos Ind ans in New Mexico
Cousin (*kö zăn*) **Jean the Elder** (1490? 1560?) French painter wood engraver and sculptor said to have painted the glass windows in the Sainte Chapelle Vincennes France ('The Last Judgment')
Cousin Jean the Younger (1522? 94?) son of Jean the Elder designed glass windows in castle of Fleurigny Sens portraits, sculpture and illustrations also ascribed to him
Cousin Victor (1792 1867) French philosopher greater as expounder of historical systems than as original thinker called greatest modern eclectic important figure 1830 to 1848 in reorganization of *French* public school system
Cousins Samuel (*1801–87*) *English* mezzotint engraver used mixed method of engraving *and etching* copied many paintings by Reynolds Lawrence Gainsborough
Covalence in *chemistry* C 218 *tables* C 218–17
Covalent bonds *or electron* **pair bonds,** also **homopolar bonds** in chemistry A 460 I 206 C 218 M 142e *pictures* C 218
Covalent compounds or **molecules** I 206 C 218 *pictures* C 218
Covarrubias (*kōv ăr-rub yäs*) **Miguel** (*mē gēl*) (*born 1902*) Mexican painter lithographer stage scene *designer* and illustrator portrays racial types and customs author *and* illustrator of Negro Drawings Island of Bali Mexico South
Cove *See in Index* Architecture, *table* of terms
Covellite a blue ore of copper C 475 M 262
Covenant Ark of the sacred chest of acacia wood which Israelites took with them into *Palestine* contained two stone tablets on which Ten Command*ments* were inscribed placed by Solomon in temple at Jerusalem similar chests now used in all *synagogues* to hold the Torah *picture* J 353
Covenanters *in* Scotland the dissent ers who bound themselves by oath or covenant to maintain Presbyterian forms and *doctrines* first *covenant* signed 1557 at inspiration of John Knox covenant of *1638* signed at Grayfriars Church Edinburgh to resist introduction of Laud's prayerbook
Covenant **of Human Rights** United Nations U 243
Covenant **of the League of Nations** L-142
Covent (*kuv ĕnt*) **Garden** London England L-300 T 112
Coventry England pop 258 211 C 502, *map* B 324
cathedral ruins *picture* E 370
Coventry send to C 502
Coverdale Miles (1488? 1569) Augustinian friar bishop of Exeter England translator of first complete printed English Bible B 135 *picture* B 136
Covered wagon *or prairie schooner* F 40 P 266–7 *pictures* F 41 P 267 A 199
Oregon Trail O 421–2 *picture* O 420
Coverley Sir Roger de simple kindly whimsical country gentleman in the *Spectator* of Addison and *Steele*
Cover paper a paper stock used for folders and booklet covers P 68a
Covert (*kŭv ĕrt*) a medium weight cloth of woolen or worsted with warp of two ply yarns one of which is white thus giving a mixed effect
Covington Ky city on Ohio River opposite Cincinnati pop 64 452 machine tools ornamental fences paper X ray equipment K 24 *maps* U 253 *inset* K 31
Cow *See also in Index* Cattle Dairying
care and feeding M 250a b *color pictures* M 250a b c
how cows make milk M 250–250a
Coward Noel (born 1899) British playwright actor composer began acting when ten extremely versatile producing revues musical comedies and serious dramas ('The Vortex' 'Easy Virtue' 'Hay Fever' 'Bitter Sweet' 'Cavalcade' 'Present Indicative' and 'Future Indefinite' autobiographies)
Cowberry *See in Index* Lingonberry
Cowbird B 203 *color picture* N 261
eggs *picture* B 203
Cowboy a rider employed to handle cattle on the western ranges of U S cowpuncher more common term in language of the range
bronco busting C 153
clothing C 154 *pictures* C 152 153 154
driving cattle to summer pasture *picture* F 35
equipment C 153 4
gaucho cowboy of Argentina A 331 2 337 *pictures* A 332 S 264 literature about L-125 monument, *picture* A 336
huaso cowboy of Chile *picture* C 265
life on the range C 150 2
lore from Mexico and Texas C 148 9
paniola cowboy of Hawaii H 288
picturesque character F 43
roundup C 149–50 *picture* C 85 *color picture* U 293
saddle C 153 *pictures* C 152 H 428*j*
songs and stories F 200 W 133 *picture C-151*
vaquero cowboy of Mexico C 147
Cowen Sir Frederic Hymen (1852–1935) English conductor *and composer* of operas oratorios cantatas *and about* 300 songs ('Sleeping Beauty' 'St John's Eve')
Cowes (*kouz*) seaport on n coast of *the Isle of Wight* pop 17 154 ship building center W 133 *map* B 325
Cow horse *a horse* trained to work with cattle C 152–3
Cowl Jane (1884–1950) actress born Boston Mass star in 'Within the Law' 'Lilac Time' 'Smilin Through' 'Romeo and Juliet' 'First Lady' coauthor 'Daybreak'
Cowley Abraham (1618–67) English poet and essayist his sonorous *lyric style* was copied by Dryden and his successors of 18th century wrote 'The Mistress' love verses 'Davideis' a scriptural epic 'Pindarique Odes'
Cowley Malcolm (born 1898) editor writer and translator born *Belsano* Pa associate editor *New Republic* 1929–44 contributor to *New Yorker* etc ('Exile's Return' 'The Dry Season')
Cow lily W 66
Cow parsnip a genus of plants (*Heracleum*) of parsley family perennial or biennial leaves large lobed and toothed flowers white or purplish grows 5 ft to 10 ft high
Cowpea a beanlike plant C 502 *picture* C 502
Cowpens S C town 9 mi n e of Spartanburg pop 1879 *British defeated* by Americans (1781) national battlefield site established here 1929 R 128b *map* S 290

Key: cāpe, ăt, fär, fȧst, what, fall; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wôn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, būrn; out;

(born 1883), British naval officer commander of expeditionary force in French North Africa Nov 1942 made commander of allied Med ter ranean fleet Feb 1943 and first sea lord and chief of the naval staff 1943–46
Cunninghame Graham Robert Bontine (1852–1936) Scottish writer and traveler in House of Commons six years ardent socialist wrote in sharp vivid ironic style (Mogreb el Acksa The Conquest of New Granada Hernando de Soto)
Cunobeline *See in Index* Cymbeline
Cupboard *a piece of furniture* period type *picture* I 177
Cupellation a process in assaying ores or refining metals A 425
Cupflower *See in Index* Nierembergia
Cuphea (*kū fē a*) a genus of annual plants of the loosestrife family mostly native to tropical America leaves oval flowers in loose clusters shading from scarlet or purple through yellow to green Mexican cigar flower (*C platycentra*) has solitary scarlet blossoms
Cupid (*ku pid*) *in Roman mythology* same as Greek Eros god of love son of Venus C 529–30 A 273
Cupola in architecture a dome resem bling an inverted cup term means *little cup and is generally applied* only to smaller domes *See also in Index* Dome
Cupola furnace F 316
Cup plant a large coarse leaved per ennial herb (*Silphium perfoliatum*) of composite family yellow flower heads upper leaves unite about *stem to form a cup shaped disk*
Cuppy William Jacob (Will Cuppy) (1884–1949) humorist and critic born Auburn Ind (How to Be a Hermit How to Tell Your Friends *from the Apes How to Become* Extinct The Decline and Fall of Practically Everybody)
Cuprammonium process for making rayon R 81
Cupressaceae (*kū pre-sā sē ē*) family of conifers T 185
Cupric (*ku prik*) term used in names of copper compounds
chloride C 475 M 285
oxide C 475
sulfate C 475
sulfide C 475
Cuprite (*ku prit*) a red ore of copper known chemically as cuprous oxide C 475 M 282 *table* M 176
Cuprous (*ku prus*) term used in names of copper compounds
oxide C 475
sulfide C 475
Cuprum Latin name for copper *table* C 211
Curaçao (*kū-ra sā ō*) largest island in Netherlands West Indies just n of Venezuela area 210 sq mi pop 95 195 chief city Willemstad *great oil refining center serves* Venezuela as ocean port trans shipping oil and other products from mainland Dutch liqueur curaçao originally made here from peel of special variety of oranges Until 1949 Curaçao was the official name for the political unit now *called Netherlands West Indies or* Netherlands Antilles *maps* W 96d S 252 V 442 *See also in Index* Netherlands West Indies
Curaray (*kū-rä rä ē*) **River** in n Ecuador rises in Andes flows e into Napo River 385 mi long
Curare (*ko-ra ra*) a poison S 432
Curassow any member *of a group of* large fowllike game birds of the family *Cracidae* with the exception of one species (*Crax globicera*) which ranges as far north as Mex ico they are found only in South America
Curculionidae (*kūr kū li ŏn i dē*) large family of insects including typical snout beetles
Curd the coagulated part of milk cottage cheese C 206
formed in stomach S 401
Curel (*kü rel*) **François vicomte de** (1854–1928) French dramatist, born at Metz plays written in a brilliant and vigorous style on ab stract themes such as science cap ital and labor
Curetes (*ku rē tēz*) Cretan priests R 132
Curfew B 121
Curia Regis (*kū ri a rē g s*) (Latin for king s co rt) instituted by Wil lia n the Conqueror as the supreme *central judicial body of England* ceased to fun tion in 1264 E 361
under Henry I and II H 335 E 361
Curia Romana (*ro n na*) the col lective body of administrative or ganizations which aid the pope in governing the Roman Catholic church P 65–6
Curiatii (*kū ri ā shi ī*) in Roman legend three brothers of Alba Longa who fought their three cou sins the Horatii R 181
Curie (*kü rē*) **Eve** (born 1904) *French author lecturer and mu* sician daughter of Pierre and Marie Curie author of Madame Curie biography of her mother *picture* C 220
Curie Irene Joliot *See in Index* Joliot Curie Irene
Curie Marie Sklodovska (1867 1934) *French physicist wife of Pierre* C 530 N 242 *pict res* C 220 R 56
discovery of radium R 53 56
Curie Pierre (1859–1906) French physi ist husband of Marie C 530 R 58 R 53 W 59
Curie a unit of rad oactivity R 55
Curiosity
child development C 240d *picture* C 242
Curitiba (*ko rē tē b*) Brazil capital of state of Paraná in s p p 141 349 railroad connection with port *Paranaguá 68 mi e exports corn* beef tobacco yerba maté medical school *maps* B 288 S 253
Curium chemical element *tables* C 214 P 151
Curlew (*kūr lu*) shore bird of family *Scolopacidae* one species the long billed curlew (*N menius ameri canus*) *ranges from Utah Idaho* Nevada and Nebraska south to Guatemala Another species is the Hudsonian curlew (*Phaeopus hud sonicus*) It is about 17 inches long bill 3½ inches in length ranges from Arctic regions of North Amer ica to s Chile and to mouth of Amazon River *S 209 pict re P 10*
Curling a game C 530 O 380 *picture* W 159
Curly-coated retriever dog *table* D 118
Curly maple, or bird s eye maple M 82
Curran John Philpot (1750–1817) Irish lawyer patriot and orator defended *Wolfe Tone and other* Irish rebels of insurrection of 1798 opposed union with Great Britain
Curran Joseph Edwin (born 1906) seaman and labor leader born New *York City became a merchant sea* man 1922 elected president of Na tional Maritime Union 1937 vice *president of C I O since 1941*
Currant a fruit C 530 *color picture* F 310
bush harbors rust R 297
host to blister rust C 530
Currant grape (*Vitis vinifera*) G 155–6 C 530
Currency money in circulation as a medium of exchange *See in Index* Coins and coinage Money Paper money
Currency *comptroller of* U S U 360
Currency fractional (sometimes called shinplasters) small coins or paper money whose face value is a fraction of the standard mon etary unit specifically paper cur rency issued in U S between 1862 and 1876 term also applied to *small denominations issued by* private bankers after War of 1812 during a shortage of metal cur rency
Confederate States C 433a
Currency Act (1764) R 121
Current electric E 294–300 *See also in Index* Electric current
Current ocean *See in Index* Ocean currents
Current events *p ct res* H 375–82
Reference Outline H 375–82
social studies include S 219
Currie Sir Arthur William (1875–1933) soldier and educator born Napperton Ontario commanded 1st Canadian D vision 1915–17 com mander in chief Canadian forces in France 1917–19 principal of McGill University 1920–33
Currier (*kūr'i ēr*) **Nathaniel** (1813–88) *American publisher introduced* Currier & Ives prints C 530–1 *See also in Index* Ives James M
print, *color picture* C 531
Curry Jabez Lamar Monroe (1825–1903) educator born Lincoln County Ga active in politics but chief work was in public education *agent of Peabody Fund for South* ern Education also of Slater Fund for Negro schools *See also in Index* Statuary Hall (Alabama) *table*
Curry John Steuart (1897 1946) painter born Dunavant Kan in terpreter of rural American life second prize Carnegie Exhibit (1933) for Tornado over Kansas painted murals for Department of Justice and Interior buildings Washington D C (1934) artist *in residence at University of Wis* consin after 1936 (The Tornado Baptism in Kansas Circus Ele phants)
'Tragic Prelude *picture* B 330
Curry powder a condiment S 341
Cursive handwriting A 179 B 235 H 258 L 100a
Curtains and draperies
American Colonies *pict res* A 193c, 201 210 bed *picture* A 210
glass *pi t re* G 119
in interior decorati n I 183 *pictures* I 176 177 179 180 182 183 184 185
Curtin Andrew Gregg (1815?–94) public official born Bellefonte Pa governor of Pennsylvania 1860–66 one of best known war governors befriended Union soldiers minister to Russia 1869–72 U S congress *man as Democrat 1881–87*
Curtin Jeremiah (1840?–1906) lin guist and world traveling folklorist born Greenfield Wis with Bureau of American Ethnology 1883 91 (*Myths* and Folk Tales of the Rus sians Western Slavs and Magyars Myths of the Modocs)
Curtin John (*1885–1945*) *prime min* ister of Australia Labor party leader formerly a trade union official and editor of *The Westralian Worker* entered Parl ament 1928 *became* prime minister October 1941
Curtis Charles (1860–1936) political leader born *North Topeka Kan*

one fourth Indian on mother's side; congressman 1893–1907; U. S senator 1907–13, 1915–29; vice-president of United States under Herbert Hoover 1929–33.

Curtis, Cyrus H. K. (1850–1933), newspaper and magazine publisher, born Portland, Me.; controlled *Saturday Evening Post, Ladies' Home Journal, Country Gentleman, Philadelphia Public Ledger, New York Evening Post.*

Curtis, George Ticknor (1812–94), jurist and writer, born Watertown, Mass.; had Dred Scott and other important cases ('Constitutional History of the United States from their Declaration of Independence to the Close of their Civil War'; 'Life of Daniel Webster').

Curtis, George William (1824–92), essayist and journalist, born Providence, R.I.; many years editor of *Harper's Weekly*; strong advocate of civil service reform; wrote 'Nile Notes of a Howadji'; 'The Potiphar Papers', a satire on New York life; 'Prue and I', his most popular book.

Curtis Cup (officially **Woman's International Cup**), trophy awarded biennially in matches between women's amateur golf team of Great Britain and that of U.S.; donated 1932 by Harriot S. and Margaret Curtis: G-138

Curtis Institute of Music, Philadelphia, Pa.; founded with endowment by Mrs. Edward Bok, 1924; students accepted on scholarship basis only after abolishment of tuition fees in 1928.

Curtiss, Glenn H. (1878–1930), pioneer aviator and inventor, born Hammondsport, N.Y.; designed many flying craft and flying-boat types; invented ailerons and seaplane; was first flier Albany to New York; won Gordon Bennett cup 1909; built many army training planes; director in engine- and plane-building firms; designed plane that won Guggenheim prize for safety: A-102
planes, *picture* A-103

Curtis turbine T-212

Curtius (*kurt'sē-us*), **Ernst** (1814–96), German archaeologist, scholar, and historian ('History of Greece').

Curtius (*kûr'shĭ-ŭs*), **Marcus**, a legendary Roman hero; an earthquake chasm in the Forum which soothsayers said would not close until it had received Rome's greatest treasure was closed when Curtius, declaring that Rome had no greater treasure than a brave citizen, rode his horse into it.

Curve, in baseball B-66, *diagrams* B-67

Curve, in mechanical drawing M-157*f*

Curved space, in Einstein theory R-100–1

Curwood, James Oliver (1878–1927), novelist, born Owosso, Mich.; traveled extensively in Canadian Northwest; wrote stirring, adventurous romances of great popularity ('Flower of the North'; 'The Valley of Silent Men'; 'The Alaskan').

Curzola, island in Adriatic Sea. *See in Index* Korcula

Curzon (*kûr'zŏn*) **of Kedleston, George Nathaniel Curzon, Marquis** (1859–1925), British Conservative statesman, governor general of India 1899–1905; held various posts in the Lloyd George cabinet; wrote several books on problems of the Far East.

Curzon line, Poland's e. border; runs roughly from Grodno s. to Brest-Litovsk; suggested by Lord Curzon 1919: P-345

Cusco, also **Cuzco** (*kos'kō*), Peru, manufacturing and trade city in s., 11,440 ft. above sea level; pop. 40,657; university; called "Rome of the Americas" because of archaeological remains *maps* P-164, S-252, *pictures* P-163
ancient Inca capital I-50

Cus'cus, opossumlike animal K-2, *color picture* P-6

Cuscus grass. *See in Index* Vetiver

Cush'ing, Caleb (1800–1879), diplomat, born Salisbury, Mass; first American minister to China, negotiated 1844 treaty defining rights of foreigners; one of three American arbitrators of *Alabama* claims; minister to Spain 1874–77; attorney general, Pierce administration

Cushing, Frank H. (1857–1900), ethnologist and author, born Northeast, Pa.; resided among Zuñi Indians and adopted into tribe, authority on habits, folklore, and language of Pueblo Indians
stories S-418

Cushing, Harvey (Williams) (1869–1939), surgeon and writer, born Cleveland, Ohio, professor surgery Harvard, 1912–33 professor neurology Yale, 1933–37; won Pulitzer prize, 1926 with 'Life of Sir William Osler', also wrote on neurological surgery.

Cushitic (*kŭsh-ĭt'ĭk*), a Hamitic language A-39

Cushman, Charlotte (1816–76) tragic actress, born Boston, called greatest Lady Macbeth of her age; played Meg Merrilies in 'Guy Mannering' Hall of Fame, *table* H-249

Cusk, a fish of the codfish family.

Cuspid teeth, canine teeth, or **dog teeth** T-34

Cuspid valves, of heart H-312, *color pictures* H-312–13

Custard apple, also **cherimoyer**, or **cherimoya**, fruit of a tropical tree of genus *Annona*; native to Peruvian highlands; known in prehistoric times; all fruits are conical in shape, but surface varies, sometimes rough, sometimes smooth; common food in tropics: F-304

Custard-apple family, or **Annonaceae** (*ăn-ō-nā'sē-ē*), a family of trees and shrubs, native chiefly to the tropics, including the cherimoya, soursop, sugar apple, papaw, ylang-ylang.

Custer, George Armstrong (1839–76), American Civil War general and Indian fighter C-531
in South Dakota S-296
massacre C-531, I-110*c*

Custer Battlefield National Monument, in Montana M-33, *map* M-18

Custer State Park, in South Dakota S-298, *picture* S-305

Custis, Eleanor Parke (1779–1852), adopted by Washington W-27

Custis, George Washington Parke (1781–1857), writer; son of John Parke Custis, Martha Washington's son by her first husband; adopted by George and Martha Washington; owned an estate at Arlington, now Arlington National Cemetery; wrote 'Recollections of George Washington', orations, and plays chiefly about Indians: W-27

Custis, John Parke ("Jack"), (1753?–81), stepson of George Washington; colonel in Revolution: W-27
home at Arlington N-17

Custis, Martha Dandridge, wife of George Washington W-125

Custis, Mary Randolph, wife of Robert E. Lee L-154

Customs, Bureau of, U S. U-360, T-16
work of Coast Guard C-371

Customs, human. *See in Index* Behavior, human; Etiquette; Habit; Sociology

Customs and patent appeals, court of, U. S. C-500

Customs court, U. S. C-500

Customs duty, tariff on imported and exported goods T-16. *See also in Index* Tariff
inspection with X rays X-331

Customshouse brokers T-16

Customshouses T-16

Customs union T-16. *See also in Index* Zollverein; Treaties, *table*

Custozza (*kos-tŏd'zä*), or **Custoza** (*kos-tôt'sä*), Italy, village 11 mi. s w of Verona; scene of two Austrian victories (1848 and 1866) in the struggle for Italian unity: I-272

Cutch, state, India. *See in Index* Kutch

Cutch, used in tanning or dyeing. *See in Index* Catechu

Cuthbert, Saint (died 687), English bishop, hermit, and missionary; life by Bede; his bones are in cathedral at Durham; festival March 20.

Cu'ticle, or **epidermis**
human skin S-192–3
leaf *picture* L-151

Cutlass, a short, heavy, slightly curved sword; formerly used by sailors on war vessels in hand-to-hand conflict.

Cutler, Manasseh (1752–1823), Congregational minister, born Killingly, Conn, chaplain in Revolutionary War army; became a physician also, did first systematic classification of New England flora; helped form Ohio Company of Associates, draft Ordinance of 1787, and colonize Ohio; lived chiefly in Hamilton, Mass., where he had a parish; served two terms in U. S. Congress.

Cutlery K-59
electroplated E-321, *picture* E-302
Sheffield S-138
stainless A-172

Cutter, Charles Ammi (1837–1903), librarian, born Boston, Mass.; librarian of Boston Athenaeum 1868–1903; helped establish *Library Journal* 1876 ('Catalogue of the Library of the Boston Athenaeum'; 'Rules for a Printed Dictionary Catalogue'; 'Expansive Classification').

Cutter, a type of boat.

Cutthroat trout, a food fish (*Salmo clarkii*) inhabiting the coastwise streams and lakes from Puget Sound to northern California; varies greatly in size; spotted with black; blotch of red at throat.

Cutting, James Ambrose (1814–67), inventor, born Hanover, N. H.
ambrotype, in photography P-226

Cutting, plant. *See in Index* Slip

Cuttle, Edward, Captain, a character in Dickens' 'Dombey and Son', *picture* D-84*b*

Cuttlefish, a ten-armed cephalopod mollusk O-337–9, M-333, *pictures* O-338
egg, *picture* E-269
sepia ink I-150
skeleton M-333

Cut work, open-work embroidery; part of fabric is cut away; Italian cut work best known.

Cutworm, caterpillar which eats off plant stems at the ground C-532

Cuvier (*kü-vyā'*), **Georges, baron de** (1769–1832), French naturalist and educator C-532

Cuxhaven (*kuks-hä'fĕn*), Germany, port and watering place on North Sea 60 mi. n. w. of Hamburg; pop 46,861; *maps* G-88, E-424

Cuyahoga (*kī-hŏg'a* or *kī-a-hō'ga*) **Falls**, Ohio, manufacturing village 28 mi. s. of Cleveland, on Cuyahoga